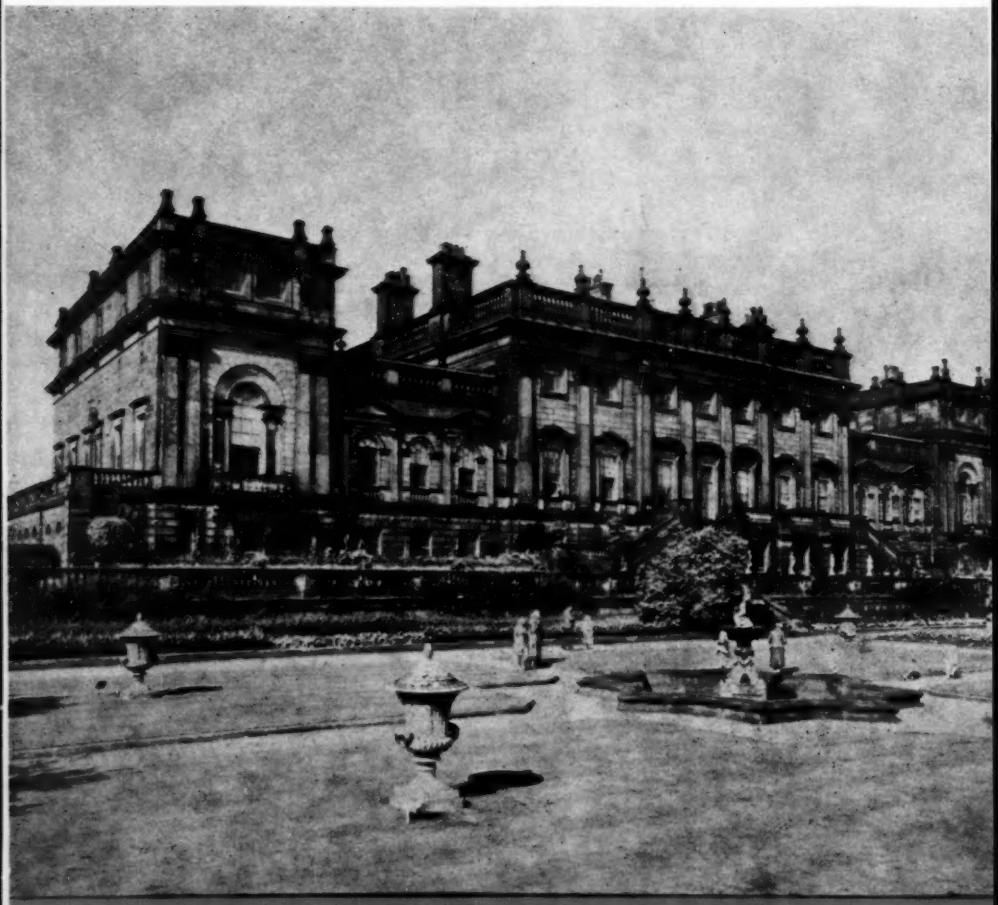
agriculture

Vol. 77 No. 8 August 1970

Published for the Ministry of Agriculture, Fisheries and Food
by Her Majesty's Stationery Office

1s 6d [7½p]
MONTHLY



The Harewood Estate page 367

The Farm as a Business

This series comprises a basic introduction to the subject and books on the major farming enterprises, and a book on labour and machinery. Each of the enterprise books contains statistical data of prices and guarantee payments, production standards, and other information related to the subject, with which the readers can compare their own farm results. The data can also by used for budgeting and planning.

No 1	Introduction to Management	**3s** (3*s* 6*d*)
No 2	Aids to Management: Beef (SBN 11 240942 3)	**2s 6d** (2*s* 10*d*)
No 3	Aids to Management: Sheep (SBN 11 240943 1)	**2s 6d** (2*s* 10*d*)
No 4	Aids to Management: Pigs	**2s 6d** (2*s* 10*d*)
No 5	Aids to Management: Poultry (SBN 11 240945 8)	**2s 6d** (2*s* 10*d*)
No 6	Aids to Management: Labour and Machinery	**2s 6d** (2*s* 10*d*)
No 7	Aids to Management: Arable Crops and Grass	**2s 6d** (2*s* 10*d*)
No 8	Aids to Management: Dairying	**2s 6d** (2*s* 10*d*)

Prices in brackets include postage

Published by
HER MAJESTY'S STATIONERY OFFICE
and obtainable from the Government Bookshops in London (post orders to P.O. Box 569, S.E.1), Edinburgh, Cardiff, Belfast, Manchester, Birmingham and Bristol, or through any bookseller

Weldmesh

Regd. Trade Mark

IN ROLLS, SHEETS AND CUT-TO-SIZE PANELS

Direct from:
THE B.R.C. ENGINEERING COMPANY,
STAFFORD *Telephone: STAFFORD 4441*

EVENSTORM IRRIGATION

★ **Rotary sprinklers** ★ **Rain guns**
★ **Organic irrigation (effluent disposal)**
★ **Portable aluminium mains**
★ **Glasshouse and outdoor spray lines**

EVENTHERM SPACE HEATERS—

★ **Portable, oil-fired, up to 200,000 B.T.Us./Hour**
★ **Free-standing with Heat Exchanger up to 400,000 B.T.Us./Hour**

Details from Dept. 'A', EVENPRODUCTS LTD., Evesham, Worcs. Tel. Evesham 6633/4.

FARM BUILDINGS

Bigger grants – cheaper money

Simplex LoCost Buildings*

Many types and sizes. Self-erection or by Simplex. Top quality architect designs at competitive prices.

Simplex Clearspan*

To cover existing installations or as general purpose buildings. Wide range of sizes.

Farm Finance Scheme

The easy way to afford new buildings. You spread cost across 5 years. But pay below market interest rates.

Available on all buildings

*Grant approved (Note: Grants increased in Price Review)

For full details write or 'phone:

A. M. A. Lawley, (Ref. No. 13),
Simplex of Cambridge Ltd.,
Sawston, Cambridge
Tel: 022-03 3281

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

Experimental Husbandry

Gives accounts of husbandry experiments carried out at both experimental husbandry and commercial farms throughout the country. It should have a wide appeal to farmers, their advisers, research workers and students.

Experimental Horticulture

Designed for commercial growers of fruit, flowers, vegetables and crops under glass, this publication contains accounts of experimental work and its bearing on practical problems in the field.

These publications are issued at irregular intervals (about twice a year)
Prices range from 6s. to 11s. (postage extra)

Government publications can be bought from the Government Bookshops in London (post orders to PO Box 569, S.E.1), Edinburgh, Cardiff, Belfast, Manchester Birmingham and Bristol, or through any bookseller

The Farm as a Business

This series comprises a basic introduction to the subject and books on the major farming enterprises, and a book on labour and machinery. Each of the enterprise books contains statistical data of prices and guarantee payments, production standards, and other information related to the subject, with which the readers can compare their own farm results. The data can also by used for budgeting and planning.

No 1	Introduction to Management	**3s** (3*s* 6*d*)
No 2	Aids to Management: Beef (SBN 11 240942 3)	**2s 6d** (2*s* 10*d*)
No 3	Aids to Management: Sheep (SBN 11 240943 1)	**2s 6d** (2*s* 10*d*)
No 4	Aids to Management: Pigs	**2s 6d** (2*s* 10*d*)
No 5	Aids to Management: Poultry (SBN 11 240945 8)	**2s 6d** (2*s* 10*d*)
No 6	Aids to Management: Labour and Machinery	**2s 6d** (2*s* 10*d*)
No 7	Aids to Management: Arable Crops and Grass	**2s 6d** (2*s* 10*d*)
No 8	Aids to Management: Dairying	**2s 6d** (2*s* 10*d*)

Prices in brackets include postage

HMSO

Published by
HER MAJESTY'S STATIONERY OFFICE
and obtainable from the Government Bookshops in London (post orders to P.O. Box 569, S.E.1), Edinburgh, Cardiff, Belfast, Manchester, Birmingham and Bristol, or through any bookseller

Weldmesh

Regd. Trade Mark

IN ROLLS, SHEETS AND CUT-TO-SIZE PANELS

Direct from:
THE B.R.C. ENGINEERING COMPANY,
STAFFORD *Telephone: STAFFORD 4441*

EVENSTORM IRRIGATION

★ Rotary sprinklers ★ Rain guns
★ Organic irrigation (effluent disposal)
★ Portable aluminium mains
★ Glasshouse and outdoor spray lines

EVENTHERM SPACE HEATERS—

★ Portable, oil-fired, up to 200,000 B.T.Us./Hour
★ Free-standing with Heat Exchanger up to 400,000 B.T.Us./Hour

Details from Dept. 'A', EVENPRODUCTS LTD., Evesham, Worcs. Tel. Evesham 6633/4.

FARM BUILDINGS

Bigger grants – cheaper money

Simplex LoCost Buildings*

Many types and sizes. Self-erection or by Simplex. Top quality architect designs at competitive prices.

Simplex Clearspan*

To cover existing installations or as general purpose buildings. Wide range of sizes.

Farm Finance Scheme

The easy way to afford new buildings. You spread cost across 5 years. But pay below market interest rates.

Available on all buildings

*Grant approved (Note: Grants increased in Price Review)

For full details write or 'phone:

A. M. A. Lawley, (Ref. No. 13),
Simplex of Cambridge Ltd.,
Sawston, Cambridge
Tel: 022-03 3281

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

Experimental Husbandry

Gives accounts of husbandry experiments carried out at both experimental husbandry and commercial farms throughout the country. It should have a wide appeal to farmers, their advisers, research workers and students.

Experimental Horticulture

Designed for commercial growers of fruit, flowers, vegetables and crops under glass, this publication contains accounts of experimental work and its bearing on practical problems in the field.

These publications are issued at irregular intervals (about twice a year)
Prices range from 6s. to 11s. (postage extra)

Government publications can be bought from the Government Bookshops in London (post orders to PO Box 569, S.E.1), Edinburgh, Cardiff, Belfast, Manchester Birmingham and Bristol, or through any bookseller

plywood pays off around the farm

Cost-saving, versatile Canadian Fir Plywood gives you quick, rugged construction using your own labour and simple tools. Easily worked, with little waste, this durable material clads portable and permanent structures of every type, including standard frame construction, clear-span rigid frame, and portal frame buildings. Later additions and modifications are simplified. Lightweight 8′ x 4′ panels are manufactured with completely WBP glue. Resists extremes of weather, and insect and fungal attack. Canadian Fir Plywood cuts your construction outlay *and* is grant-earning for buildings approved by the Ministry of Agriculture. For literature on Canadian Fir Plywood for farm buildings, the names of local stockists of Canadian Fir Plywood, and a list of farm-building manufacturers, write to:

Council of the Forest Industries of British Columbia

Incorporating the BC Lumber Manufacturers (BCLM) and the Plywood Manufacturers of BC (PMBC)

Templar House, 81 High Holborn, London WC1
Telephone: 01-405 1105

make sure it's Canadian Fir Plywood

PM41

Agriculture

VOLUME 77 . NUMBER 8 . AUGUST 1970

Editorial Offices
Ministry of Agriculture, Fisheries and Food
Tolcarne Drive
Pinner
Middlesex HA5 2DT 01–868 7161

Contents

	page
Finger Carrots *Andrew Brown*	350
The National Trust *Ivan Hills*	354
Flower Bulb Production *J. B. Briggs*	358
Seed Potato Gangrene *J. M. Proctor*	363
Harewood Estate *G. E. M. Hildred*	367
Nature Conservancy *Dr. P. A. Gay*	371
Living Grain *G. T. Bills*	375
Ministry Publications	379
British Barley for British Beer *P. H. T. Evans*	380
Land Reform in Iran (Part 1) *Prof. D. R. Denman*	384
Farming Cameo Series 4: 37. Radnorshire *A. W. Prowel*	387
From the ALS: Thoughts on Farm Traffic *R. C. Leeson*	390
In brief	392
Book Reviews	394
Agricultural Chemicals Approval Scheme	396

© *Crown copyright 1970*

Provided that the source is acknowledged in each instance such articles and notes as are published in this Journal without any specific reservation regarding copyright may be produced in any registered newspaper or public periodical without special permission. The Ministry does not accept responsibility for statements made, or views expressed, in signed contributions to this Journal or in those reproduced from another source.

Further, the Ministry does not accept responsibility for any of the private and trade advertisements included in this publication.

In the interests of factual reporting, occasional reference in this Journal to trade names and proprietary products may be inevitable. No endorsement of named products is intended, nor is any criticism implied of similar products which are not mentioned.

All communications respecting advertising in the Journal should be addressed to the Advertisement Contractors, Cowlishaw and Lawrence (Advertising) Ltd., 2-4 Ludgate Circus Buildings, London E.C.4. Telephone: 01-248 3718.

For straight facts about electricity... ask the Electro-Agricultural Centre

The Electro-Agricultural Centre is designed to help you with all aspects of electricity in farming. Here you can get free, accurate and unbiased information about the best equipment for your particular needs. In the main display hall of the Centre you can see examples of the latest systems and equipment for controlled livestock environment, hay drying, potato storage, feed preparation, water heating, refrigeration, frost protection and so on.

Qualified staff backed by a comprehensive library are able to deal with most problems on the spot.

What is more, the Electro-Agricultural Centre is right in the heart of the National Agricultural Centre – where further demonstrations of electrical equipment can easily be seen.

Organised visits (county or local) can be arranged through your Electricity Board. If you cannot come along, write or telephone the Centre and your queries will be promptly dealt with. This service is completely free so why not make full use of it.

The Electro-Agricultural Centre, National Agricultural Centre, Kenilworth, Warwickshire. CV8 2LS Telephone: 0203 27486.

The Electricity Council, England & Wales.

The Rt. Hon.

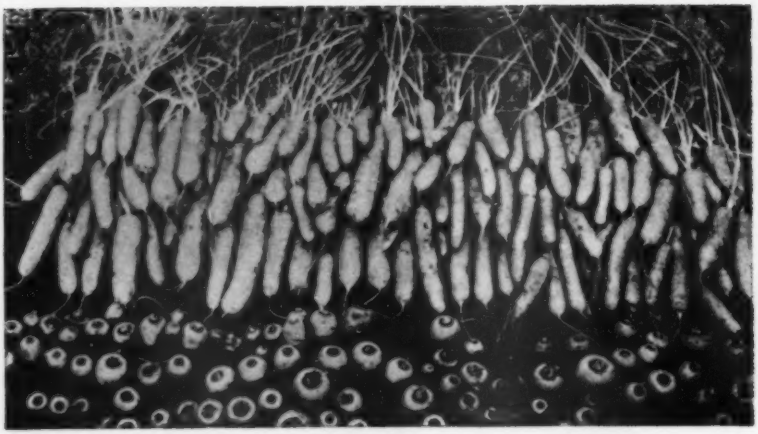
James Prior, M.P.

Minister of Agriculture,
Fisheries and Food

I would like, in taking up my new office, to send this personal greeting to the readers of 'Agriculture'. I am conscious of the important task the Prime Minister has given to me and of the responsibilities that it entails.

We have said that we intend to make changes in the system of support so as to provide much needed scope for agricultural expansion. We have also said that we shall discuss with all those concerned the practical implications of such changes before we embark on them. This we shall do.

I am certain that our farmers have an important part to play in the future prosperity of the nation. An efficient and expanding home agriculture can make a vital contribution to our economic progress. It will be my concern to provide the conditions in which it can make that contribution.



Resulting from an increased interest being taken by growers for carrots of the Amsterdam Forcing variety type for pre-packing, the author discusses

Finger Carrots

Andrew Brown

A MARKETING report in 1952 referred to 'a kind of new carrot serving a very limited demand for high class produce when young tender bunched carrots are not available' which was being imported from Holland. First consignments were assessed as 'very good, the only defect being the liability of the roots to break due to their long cylindrical shape and brittleness'. The report ended by saying that 'There is no question of imports of this type of carrot competing directly with English maincrop varieties; the Dutch carrot is a semi-luxury product with a limited market only'.

As the name 'finger carrot' implies, it is a type of the Amsterdam Forcing variety with long cylindrical finger-like roots that command a retail price of between 1*s*. 6*d*. and 2*s*. per lb in the shops at a time of the year when a ware sample is being sold at less than 6*d*. per lb.

Pre-pack requirements

The pre-packer is demanding a carrot with a good, deep coloured skin and a red core; a carrot that must be washed clean without silvering, with the tops removed and without any blemishes. He normally stipulates two

size grades; small ½–¾ in. diameter and approximately 3–4½ in. long and a medium size ¾–1 in. diameter 4½–6 in. long. These are usually required packed in polythene bags.

It is usual to choose a variety of the Amsterdam type; the seven varieties which have cropped well in different parts of the country and on different soils are:*

Amsterdam Forcing (P. de Jongh)	Amsterdam Forcing (Nunhem)
Amsterdam Forcing 461 (Jong)	Amsterdam Outdoor (A. R. Zwaan)
Amsterdammer Bak (Rijk Zwaan)	First Pull (Webb)
Springtime (Nunhem)	

Method of production

The system of plant arrangement is dictated mainly by the method of harvesting to be used, whether it be hand harvesting or machine harvesting, and to a certain extent by the type of drill.

Harvesters. The ideal arrangement for the efficient use of a top lifting type of harvester is a system of three rows 1 in. apart or a 2 in. scatter row giving a mature width at harvest of not more than 4 in. with 15 in. wheelings, or 18 in. on fen soils where the vigorous top growth can result in the tops becoming entangled. The quality of the work done by the harvester is dependant on having obtained near the optimum plant population of between twenty and thirty plants per sq. ft of field area, the lower figure being recommended where early lifting is planned within fifteen weeks of drilling; the higher rate is more suitable for a longer standing crop.

The top lifting harvester is particularly suitable for use on stony land because it avoids the need for a stone separator in the grading line. Its use is, of course, limited to that period when there is sufficient top on the carrot to allow the belts to grip. The best system for efficient lifting with a squeezing type share of a *hoover* type harvester demands a bed width of not more than 10 in. This can be made up of five rows 2½ in. apart or eleven rows 1 in. apart giving path widths of 20 in. between beds or 30 in. centres. Wide beds up to 42 in. with 18 in. pathways and 60 in. centres are also used for the production of the crop and, although some are hand-lifted, harvesters fitted with double shares can be used to lift this wide bed. Usually the carrots are lifted by machine and then dropped back on to the ground so that a rough grading, as well as a reduction in damage, is obtained by picking up from the ground by hand. Higher plant populations are possible with wider bed systems reaching up to approximately fifty plants per square foot.

Drills. A better distribution of the plants within a bed is possible with the use of a precision drill capable of drilling rows down to 1 in. apart and depositing seeds singly in the rows. External force feed drills designed for cereal drilling can also be used to drill rows down to 3½ in. apart. It is also possible to drill scatter rows in bands 2–3 in. wide by using the coulter to split the stream of seed from the outlet orifice into two rows leaving a gap in the middle.

---

*See National Institute of Agricultural Botany: Vegetable Growers Leaflet No. 4, *Varieties of Maincrop Carrots.* Available from the Librarian, N.I.A.B., Huntingdon Road, Cambridge, price 6*d.* and stamped addressed envelope.

To produce the maximum yield in the grade required it is necessary to establish as near as possible the optimum plant population for the system used and to harvest at the correct time.

Sowing rate. This has to be adjusted to obtain the desired plant density because there is a marked difference in the seed count between different samples of seed of the same variety; this can range from 16,000 to 45,000 seeds per oz. The laboratory germination can also vary from 60 to 100 per cent. Different sowing rates may, therefore, be necessary to establish the same plant population.

The rate can be calculated by using the following formula:

$$\text{Seed required in lb per acre} = \frac{272 \times \text{number of plants required per sq. ft of field area}}{\text{Number of seeds per oz in thousands} \times \% \text{ laboratory germination} \times \text{field factor}}$$

The field factor is included to take account of the differences between the laboratory germination and the emergence of seedlings in the field. It can be assessed only by experience. Under adverse drilling conditions, e.g., dry soil and poor tilth, it might be estimated that only half the seed that germinated in the laboratory will emerge; the field factor would then be 0·5. In good conditions a field factor of 0·75 might be used. This formula gives only the quantity of seed necessary to drill an acre.

The approximate number of plants per square ft of field area to produce a high proportion of carrots in the pre-pack or 'finger' grades and using a system suitable for a hoover type harvester, i.e., at 10 in. wide band, is approximately 35–40. To calculate the number of plants required in the bed area the following simple formula can be used:

$$\frac{35 \text{ (plants per sq. ft of field area)} \times 30 \text{ (width of bed centres)}}{10 \text{ (bed width)}} = 105 \text{ plants per sq. ft of } \textit{bed} \text{ area.}$$

To calculate the number of seeds required per sq. ft of bed area to establish 105 plants the laboratory germination and the field factor must be applied:

$$\frac{\text{Plants per sq. ft of bed area (105)} \times 100}{\% \text{ laboratory germination (70\%)} \times \text{field factor (0·5)}} = 300$$

This means that only 35 per cent of the seed drilled is expected to emerge as plants in the field, so that it will be necessary to drill approximately 300 seeds in a sq. ft of bed area, i.e., eleven rows each 14·4 in. long with seeds approximately $\frac{1}{2}$ in. apart in the rows.

Harvesting. This has a marked influence on the proportion of carrots within the required grade and much more information is needed about the optimum time to enable some form of programming to be done. The Arthur Rickwood Experimental Husbandry Farm on the fenland has included work on the production of finger carrots in their programme. Observations suggest that approximately sixteen weeks from sowing is about optimum and that over a period of one month the yield in the required grade does not change very much. Programming for harvest also reduces the problem of carrot fly, confining the attack to possibly only one generation.

Frost protection. Strawing down the very wide beds is economically justified for finger carrots due to the high yields possible with this system and the market returns during the period after Xmas. Up to 8 tons of loose straw

forked loosely over the crop to a depth of 6–8 in. can cost up to £80 per acre, taking into account the cost of the straw and the labour involved in applying and removing it.

The narrow bands can, of course, be earthed up to protect from frost; this is a practice on the fenland. For very early finger carrot production single rows 12–15 in. apart with 5–10 plants per sq. ft can result in an even earlier crop. In East Anglia, however, harvesting of the first crop does not normally take place until the first week in July.

Increasing home production

Since the 1952 report we have seen an increasing interest being taken by growers in this country, particularly in East Anglia, in the production of this type of carrot for pre-packing. The quantity produced is still very small but the demand, mainly by the leading chain stores, is growing.

It is during the period March–June when supplies are imported from Portugal and the United States. It is then that attempts are being made to produce the crop in the more forward parts of the country, for example in West Cornwall and the Scilly Isles. The use of polythene tunnels is also being explored in these areas.

This article has been contributed by **Andrew Brown, D.H.E., Dip.Hort.,** Assistant Regional Vegetable Specialist for the N.A.A.S. in the Eastern Region.

Spray Drift

Farmers, growers, and both aerial and ground spraying contractors are reminded that drifting spray, particularly of weed-killers, can cause severe—and expensive—damage to neighbouring fields, nurseries and gardens and may contaminate crops it is not intended to reach.

Before starting to spray, either on the ground or from the air, operators should take account of wind conditions and their effect on drift and should postpone spraying if conditions are unsuitable. During spraying a careful watch should be kept for wind changes so that work can, if necessary, be stopped until conditions improve.

Neighbouring farmers and other people living very close to the site should be warned in advance when spraying is expected to take place. They can then, if they wish, take special precautions such as keeping livestock and pets under cover and bringing washing indoors. Local beekeepers should also be told of the expected date and time of spraying of chemicals harmful to bees.

Glencoyne Farm, Ullswater, Cumberland. The building on the right comprising garage, barn, clipping and implement shed, was built by the Trust, using traditional materials of stone and slate to blend with adjacent buildings. The sheep handling pens won premier awards in 1968 in the C.L.A. and Farmers Weekly competitions

The National Trust for Places of Historic Interest and Natural Beauty was founded in 1895. This article sets out its aims and intentions with regard to its agricultural land

The National Trust

Ivan Hills

History

At the end of the last century there was little effective control over development in the countryside. Much beautiful land had already been ruined by ill-sited and ugly industrial sprawl, and more was threatened by people who wished to build houses in beauty spots still unspoiled. Perhaps the threats were greatest in the Lake District, Surrey and Kent, and from these quarters came the initiative that founded the National Trust in 1895 as a voluntary society, later to be incorporated by the National Trust Act 1907.

This Act states the main purpose of the Trust to be 'the permanent preservation for the benefit of the nation of lands and tenements (including buildings) of beauty or historic interest and as regards lands for the preservation (so far as practicable) of their natural aspect, features and animal and plant life'.

The words 'for the benefit of the nation' are significant. Here is a voluntary and charitable body, supported largely by private subscriptions, charged with a national responsibility for preservation—a responsibility that could,

and sometimes does, cause confrontations with certain departments of the central and local government. The Trust's special position is recognized by its ability, under the Act, to hold land inalienably for permanent preservation. This means that the freehold cannot be disposed of, nor can it be compulsorily taken against the Trust's wishes unless Parliament so decides. This is a powerful factor enabling long-term management to be carried out.

From modest beginnings, the properties have gradually increased both in number and diversity, especially during the period following the Second World War. Now 362,000 acres are owned, and a further 64,800 acres are protected by covenants in England, Wales and Northern Ireland (Scotland has its own National Trust). Sometimes funds are raised by public appeal for a specific purchase, and on occasions property can be bought with money provided for that purpose; but nearly all the land has been given or left by will to the Trust.

The farms

There are now 950 farms covering 153,000 acres, of which 70,000 acres belong to hill farms. There are also extensive areas of rough grazing, principally on the uplands. Most farms come to the Trust because the land is beautiful or because it forms an endowment for, or is needed for the protection of, an important country house. The resultant distribution of our farms throughout the country means that they vary enormously in almost every respect: size, soil, climate, altitude, fixed equipment and, most important of all, the character of the tenant. The Trust does not itself farm any land but lets it all on agricultural tenancies.

It is comparatively rare that a good, well-equipped farm is acquired, for beautiful land is often relatively unproductive. Sometimes a potentially good farm has gone back because either the owner could no longer afford to maintain and equip it, or the tenancy has proved a failure.

Finance

The Trust has done much to make its farms more productive, particularly by the provision of new buildings towards which the Government's farm improvement schemes have contributed valuable grants. Over the five years to 1969 an average of £75,000 a year has been spent on modernizing farm cottages and providing up-to-date buildings. Increases in productivity, and hence in rents, have made this a sound investment for both landlord and tenant, but it has been possible only because of free legacies and gifts to the Trust; a continuance of money from this source is relied upon to keep up the rate of improvements. No landowner, not even the Trust with charitable exemption from tax, can hope to accumulate from rents sufficient capital to re-equip its farms. The burden of repairs, insurance and management leaves a very small net income when deducted from gross rent, and there is no general foundation fund available for new buildings. Its slender reserves are barely adequate for the Trust's many other commitments, and the present situation, where costs are going up faster than income, gives cause for concern. Farmers are facing the same sort of problem and it is not surprising that many are dissatisfied over prices, and worried about the future.

Farm structure

The cost of equipping even a modest farm today is very heavy and the credit squeeze, combined with high interest rates, makes matters worse. To

spread costs landowners are increasing the size of farms, but they can achieve this only when vacant possession is obtained. The Trust, therefore, has to make long-term plans for farm amalgamations which can be implemented only gradually as farms become vacant.

Amalgamation, though often desirable and necessary, must be approached with caution, especially in some of the upland areas of Wales and the Lake District where the pattern of the small family farm seems essential if the social life of the community is to survive. This also ensures vitality for the district, and a supply of people on the spot who can help out their neighbours at times of seasonal pressure. In such circumstances the Trust does not seek to hurry the changes which economic factors may, in time, bring about.

Farm buildings

Wherever possible, the Trust retains the traditional character and appearance of its farm buildings, which often vividly reflect the local materials and craftsmanship of the past. Indeed many farmhouses and buildings are historic monuments of outstanding importance—for example, Great Coxwell Tithe Barn near Faringdon, Berkshire, built of stone in the thirteenth century with exceptionally fine timbering in the roof which is 48 ft high.

Inevitably many of these traditional buildings are inadequate for modern needs, and new ones have to be provided in such a way as to harmonize, wherever possible, with the old.

Particular problems occur in hill areas—such as the Lake District—where traditional buildings tend to form an important feature in the landscape; but success can often be achieved by careful siting and the use of local stone. This is expensive, but is accepted by the Trust as one of its responsibilities.

Elsewhere, the need for new buildings of wide span and high roof levels calls for much thought at the planning stage to achieve harmony with their surroundings. Modern methods of preserving timber have enabled wood to be used for framing and cladding, and this presents a happier and less stark appearance than concrete or asbestos, usually with a saving in cost. Roofing materials are still a problem because, for reasons of cost, corrugated asbestos is virtually the only acceptable type for a building of any size. When weathered it is not unpleasing, but where big areas are prominent, or near old tile or slate roofs, it is often better to paint the asbestos grey-green or black, depending on the setting, or to use special pre-treated sheets.

The Trust has won several awards in the Country Landowners' Association's and similar competitions for the design of farm buildings and sheep pens.

Conservation

One of the Trust's main purposes is to protect the beauty of the countryside and its animal and plant life. This has to be reconciled with its duty to encourage tenants to farm well and produce food economically. It is not always easy to hold the balance, but with goodwill and understanding, which implies a careful appreciation of all points of view, such conflicts as arise can usually be settled. Most tenants understand the Trust's concern to strike a fair balance, for example, between keeping the old hedgerow

Manor Farm, Branscombe, Devon

pattern and the needs of modern farming, or between retaining the tree-covered character of a landscape and the requirements of the combine-harvester. They are prepared to modify their farming operations within reason, in the knowledge that a consequent adjustment in the rent will be made where fairness demands it.

The Trust welcomes the Ministry of Agriculture's recent decision to train selected field staff in conservation so that they may help to emphasize to farmers the importance of this facet of their land use. Of course many farmers are practising long-term conservation in the realization that exploitation of every inch of land is usually undesirable.

Public access

The Trust's aim is to allow public access to all its land subject to the needs of farming, forestry and nature conservation. Tenants' interests are protected by their farm agreements, and they understandably object to people picnicking in ripening hay, trampling on growing crops, or allowing dogs to chase stock. On land close to large centres of population or where intensive farming is practised the public may have to be restricted to footpaths, bridleways and, where appropriate, such special parts of the farm as are agreed with the tenant. Over large areas of the Trust's farmland, especially near the coast and in the hill areas of Wales, the Lake and Peak Districts, people can walk at will provided they are considerate and keep dogs under control. This is achieved through the tolerance and understanding of the farm tenants, who know they can count on their landlord to co-operate by exercising control over visitors where necessary.

The future

In an uncertain world there are still a few certainties. We can be sure that farming will continue to encounter difficulties. Capital is likely to remain scarce and expensive to raise, while the demand for cheap food will continue: pressure for more public access to the land will intensify.

We can be equally certain that farmers will continue to meet the challenge as they have done so often in the past. The permanent nature of the National Trust's ownership of its land should give to its tenants a reassuring sense of security at a time when the future of the industry holds so many problems.

This article has been contributed by **Ivan Hills, F.R.I.C.S.**, who is the Chief Land Agent to the National Trust.

spread costs landowners are increasing the size of farms, but they can achieve this only when vacant possession is obtained. The Trust, therefore, has to make long-term plans for farm amalgamations which can be implemented only gradually as farms become vacant.

Amalgamation, though often desirable and necessary, must be approached with caution, especially in some of the upland areas of Wales and the Lake District where the pattern of the small family farm seems essential if the social life of the community is to survive. This also ensures vitality for the district, and a supply of people on the spot who can help out their neighbours at times of seasonal pressure. In such circumstances the Trust does not seek to hurry the changes which economic factors may, in time, bring about.

Farm buildings

Wherever possible, the Trust retains the traditional character and appearance of its farm buildings, which often vividly reflect the local materials and craftsmanship of the past. Indeed many farmhouses and buildings are historic monuments of outstanding importance—for example, Great Coxwell Tithe Barn near Faringdon, Berkshire, built of stone in the thirteenth century with exceptionally fine timbering in the roof which is 48 ft high.

Inevitably many of these traditional buildings are inadequate for modern needs, and new ones have to be provided in such a way as to harmonize, wherever possible, with the old.

Particular problems occur in hill areas—such as the Lake District—where traditional buildings tend to form an important feature in the landscape; but success can often be achieved by careful siting and the use of local stone. This is expensive, but is accepted by the Trust as one of its responsibilities.

Elsewhere, the need for new buildings of wide span and high roof levels calls for much thought at the planning stage to achieve harmony with their surroundings. Modern methods of preserving timber have enabled wood to be used for framing and cladding, and this presents a happier and less stark appearance than concrete or asbestos, usually with a saving in cost. Roofing materials are still a problem because, for reasons of cost, corrugated asbestos is virtually the only acceptable type for a building of any size. When weathered it is not unpleasing, but where big areas are prominent, or near old tile or slate roofs, it is often better to paint the asbestos grey-green or black, depending on the setting, or to use special pre-treated sheets.

The Trust has won several awards in the Country Landowners' Association's and similar competitions for the design of farm buildings and sheep pens.

Conservation

One of the Trust's main purposes is to protect the beauty of the countryside and its animal and plant life. This has to be reconciled with its duty to encourage tenants to farm well and produce food economically. It is not always easy to hold the balance, but with goodwill and understanding, which implies a careful appreciation of all points of view, such conflicts as arise can usually be settled. Most tenants understand the Trust's concern to strike a fair balance, for example, between keeping the old hedgerow

Manor Farm, Branscombe, Devon

pattern and the needs of modern farming, or between retaining the tree-covered character of a landscape and the requirements of the combine-harvester. They are prepared to modify their farming operations within reason, in the knowledge that a consequent adjustment in the rent will be made where fairness demands it.

The Trust welcomes the Ministry of Agriculture's recent decision to train selected field staff in conservation so that they may help to emphasize to farmers the importance of this facet of their land use. Of course many farmers are practising long-term conservation in the realization that exploitation of every inch of land is usually undesirable.

Public access

The Trust's aim is to allow public access to all its land subject to the needs of farming, forestry and nature conservation. Tenants' interests are protected by their farm agreements, and they understandably object to people picnicking in ripening hay, trampling on growing crops, or allowing dogs to chase stock. On land close to large centres of population or where intensive farming is practised the public may have to be restricted to footpaths, bridleways and, where appropriate, such special parts of the farm as are agreed with the tenant. Over large areas of the Trust's farmland, especially near the coast and in the hill areas of Wales, the Lake and Peak Districts, people can walk at will provided they are considerate and keep dogs under control. This is achieved through the tolerance and understanding of the farm tenants, who know they can count on their landlord to co-operate by exercising control over visitors where necessary.

The future

In an uncertain world there are still a few certainties. We can be sure that farming will continue to encounter difficulties. Capital is likely to remain scarce and expensive to raise, while the demand for cheap food will continue: pressure for more public access to the land will intensify.

We can be equally certain that farmers will continue to meet the challenge as they have done so often in the past. The permanent nature of the National Trust's ownership of its land should give to its tenants a reassuring sense of security at a time when the future of the industry holds so many problems.

This article has been contributed by **Ivan Hills, F.R.I.C.S.,** who is the Chief Land Agent to the National Trust.

Flower Bulb Production

J. B. Briggs, *Kirton Experimental Horticulture Station*

FLOWER bulbs grown in England and Wales occupy some 13,200 acres; narcissus account for 8,700 acres, tulips 3,700 and Iris 430, the remainder being used for the production of anemones, crocus, gladiolus and lilies. Although grown to some extent in most counties, the two main areas are in Lincolnshire and the South-West of England. Holland, Lincolnshire, with 7,500 acres of bulbs, produces some 55 per cent of the narcissus and 70 per cent of all tulips grown in this country; because of the suitability of soil and climate, the concentration of know-how and the presence of the skilled workers, it is the established centre of the British bulb industry.

In recent years, production has developed in other areas of the Eastern Region where soils are suitable and considerable acreages of narcissus and tulips are now grown in Lindsey and Norfolk. In all these areas the bulbs are grown for both bulb and flower production, dry bulbs being sold for commercial forcing and field planting as well as for domestic use. In Holland, particularly around the Spalding area, large quantities are forced in glasshouses during the winter months, thus enabling the grower to retain his skilled workers for year-round employment.

Of the 1,400 acres of bulbs grown in the South-West, 1,000 are narcissus. Due to the equable climate, production is largely devoted to outdoor flowers, the season starting in November and December and continuing through to mid-May. With improved pest and disease control, yields have so increased in recent years that bulbs surplus to planting requirements are now being sold.

This article describes methods of production common to the main area of production as well as outlining work on some aspects at Kirton Experimental Horticulture Station.

Soil

The deep, fine-textured soils, commonly known as 'silts', of Holland, are most suitable for high yields of good quality bulbs. They retain moisture and seldom dry out, even in a drought. However, in wet seasons they can be difficult to handle and, if wrongly treated, soil structure problems arise; for instance, panning, soil capping and clod formation limit growth and hinder efficient mechanical lifting.

Narcissus are more tolerant of adverse soil conditions than tulips and can be grown on a wider range of soil types. Tulips are more exacting in their requirements; well drained, moisture-retentive soil with a high lime content is essential for satisfactory cultivation. Freedom from stones is also important to avoid damage to bulbs and reduce separation problems at lifting.

Manuring

The silt soils, being highly fertile, provide the high levels of soil fertility that bulbs require. Work on tulip nutrition at Kirton E.H.S. showed the importance of fairly high levels of potassium and moderate levels of phosphate and nitrogen. The interaction between nitrogen and potassium was significant, with the response to potassium being greater when nitrogen was also supplied. Nitrogen was generally favourable when potassium was also given but not when potassium was omitted.

A general fertilizer recommendation would be 40–60 units N, 60 units P_2O_5 and 120–150 units K_2O per acre for both narcissus and tulips. Where narcissus are grown on a two-year-down basis, approximately 40 units nitrogen is often applied when cultivations take place in the summer after planting.

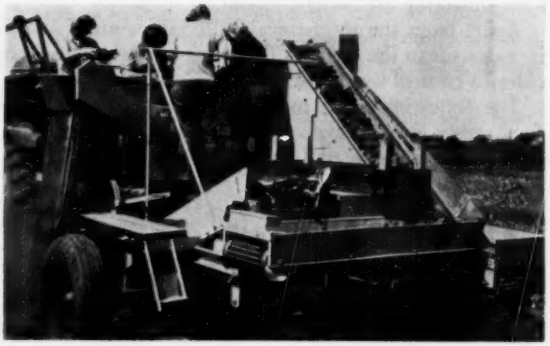
Soils with a high lime content are desirable, especially for tulips which will not tolerate acid conditions. Soils with a pH value between 7·0 and 7·5 are ideal.

Planting and lifting

Four to five tons of narcissus and 175–200 thousand tulips, depending on the size of bulb and cultivar, are usually planted per acre to give a 100–150 per cent increase in yield at lifting. Spacing experiments are in progress at Kirton E.H.S. to determine the optimum bulb density in relation to bulb size for narcissus and tulips grown in ridges. At the end of this work sufficient information should be available to make it possible to recommend the optimum density of a particular size planted to give the maximum number of bulbs lifted in the size grades required.

Until fairly recently, most bulbs were grown on the flat in 6-row beds. However, the shortage of casual labour to plant and lift bulbs from beds has meant a change-over to growing in ridges, usually 28–32 in. apart. Although more land is required, this method has simplified both planting and lifting; machines needing only slight modification to plant narcissus, tulips or potatoes are widely used with satisfactory results.

A wide range of lifters is used. Although machines which place bulbs on the soil surface for hand-picking are still used, particularly on small units, many growers are now using potato-type complete harvesters for narcissus and tulips. Narcissus are lifted into nets or trays or, more frequently,



A complete bulb harvester lifting narcissus

into trailers alongside the harvester. Tulips are lifted into nets or trays and kept in trays during subsequent cleaning and storage. Narcissus lifted in bulk are cleaned immediately and then trayed-up for storage or put into containers for hot-water treatment if they are to be replanted. Some growers are now drying and storing narcissus bulbs in bulk, using the same equipment as for grain and other crops.

Weed control

Weed control is an important aspect of bulb production and one in which Kirton E.H.S. has been concerned since the introduction of the first herbicides.

Experimental work has shown that weed growth can seriously affect bulb yield, particularly if competition occurs when the bulbs are bulking and forming new bulbs. It is weed growth in April and May which causes most yield reduction in narcissus, and that in May and early June in tulips. Later weed growth does not normally reduce yields and in most cases ridges can be cleaned mechanically before lifting; but weeds (notably knotgrass) not easily removed mechanically can cause problems where complete harvesting techniques are used.

Correct timing of herbicide applications is important, especially with tulips; severe damage can result if they are used at certain stages of crop growth. Normally residual herbicides are applied to narcissus and tulips during the winter, before crop emergence. However, in mild winters narcissus down for a second year often have two or three inches of leaf showing in January and tulips may show an inch of leaf as a spike (furled leaf stage) by February. If weather conditions have made earlier spraying impossible, a grower may have to spray when bulbs are at this stage. Timing of these early post-emergence sprays is critical, particularly on tulips, and experience has shown that severe crop damage will result if they are applied after the furled leaf stage when the leaves have opened out to form a cup in which the herbicide can collect. Recent experimental work on the applications of herbicides to narcissus and tulips before and after flowering to prevent late weed germination has shown that certain materials can damage both crops when applied after the early post-emergence stage. Also, all the herbicides used so far have caused serious yield reduction to tulips when applied after that stage, when the bulb is growing rapidly and the flower stem elongating before flowering. Applications after flowering are being checked.

Apart from the mechanical cultivations and re-ridging which take place in narcissus in the summer following planting, most growers now use herbicides to control weeds from planting to lifting.

The following recommendations relate to mineral soils classed as very fine, sandy loams; coarser, more open soils and soils with a high organic matter content may give different results at the rates quoted.

Contact herbicides are necessary to kill weeds which germinate in the autumn after planting and to clean up the ridges after the first year. It is very important to ensure that no bulb foliage is present when they are applied.

Residual herbicides used in December/January before crop emergence are more effective if applied to a weed-free soil. One of the following can be

used on narcissus and tulip, the choice depending on the weeds to be controlled:

Chlorpropham 2 lb + diuron 0·4–0·8 lb a.i. per acre
Chlorpropham 2 lb + linuron 0·5–1 lb a.i. per acre
Alicep 4 lb a.i. per acre

Where Alicep is used its contact action on some weed seedlings is valuable if the soil is not weed-free at the time of application. Early post-emergence applications of residual herbicides on narcissus and tulip include:

Chlorpropham 2 lb + diuron 0·4–·8 lb a.i. per acre
Alicep 2–4 lb a.i. per acre
Chlorpropham 2 lb a.i. per acre

Pest and disease control

To maintain health and vigour, it is important that narcissus and tulip stocks are inspected at regular intervals during the growing season; bulbs not true to type and those infected with pests or diseases are rogued out. Roguing for stem and bulb eelworm and virus diseases is commonly practised in both crops, whilst tulips are also rogued for primary infectors of the disease tulip 'fire'.

The stem and bulb eelworm (*Ditylenchus dipsaci*) is one of the major problems of bulb growing; it is of widespread occurrence in narcissus stocks, to a lesser extent in tulips. The use of a 6–8 year rotation, during which time no other bulbous crops should be grown, with strict hygiene during bulb handling and storage are of utmost importance. The only satisfactory control in narcissus at the present time is to hot-water treat the bulbs for three hours at 112°F every time they are lifted. Bulbs of infested stocks should be treated immediately after lifting to avoid eelworm build-up and spread during subsequent storage, even though treatment at this time is likely to result in flower damage. Stocks not known to be infested should be treated from the beginning of August when the flower is fully formed inside the bulb. Bulbs should not be treated when the root initials have started to grow, usually from the beginning of September onwards, as serious root damage may result. For this reason cultivars such as Actaea, Carlton and Cheerfulness, which start root growth early, should always be hot-water treated at the beginning of August. Tulips are seriously damaged by the treatment and, where eelworm is present in a stock, control is achieved by roguing out infested bulbs during the growing season and dipping the remainder in the nematicide thionazin (Nemafos) at lifting.

Bulb scale mite has increased in importance in recent years. It is normally kept under control by hot-water treatment and causes no trouble on field crops but under glasshouse conditions it builds up rapidly to become a serious pest of forced narcissus.

Tulip fire (*Botrytis tulipae*) is the most common disease of tulips in Britain. If weather conditions favour its spread in the field serious leaf losses may occur with a consequent lowering of bulb yield and increased risk of bulb infection. Results at Kirton E.H.S. show that regular applications of efficient fungicides such as dichlofluanid, mancozeb, zineb and mancozeb/zineb, will give a good control of 'fire' on the leaf and increase bulb yields; but they will not prevent bulb infection or the amount of disease in subsequent years. Roguing out of primary infectors is necessary to reduce the amount of secondary spread of the disease.

Early spraying from 100 per cent emergence is important. As it is necessary to maintain a protective coverage of fungicide, it is usual to spray at two to three week intervals as the leaves emerge and enlarge, gradually lengthening the cycle as the season progresses unless 'fire' is seen to increase in May. One final spray after flowering is all that will be required in a dry season.

Complete control will be possible only if the disease can be killed in the bulb, thus preventing primary infectors and underground transfer. Work is at present in progress at Kirton E.H.S. and the Glasshouse Crops Research Institute to find fungicides which give effective control as bulb dips prior to planting.

The incidence of Basal rot, caused by *Fusarium* spp. has increased in stocks of narcissus and tulips in recent years and the effectiveness of the new benzimidazole fungicides in controlling this troublesome storage disease is being investigated.

Varieties

Of the large number of narcissus and tulip varieties in existence relatively few are grown in large quantities. The most important tulip varieties include Apeldoorn, Paul Richter, Rose Copland, Merry Widow, Golden Harvest, London and Elmus. The main narcissus varieties are Golden Harvest, Carlton and Fortune. Other narcissus and tulip cultivars are grown in limited quantities to meet the needs of domestic outlets.

Marketing

After lifting, narcissus and tulips are cleaned and graded preparatory to re-planting or sale. Narcissus are cleaned mechanically after which individual bulbs are separated and diseased or damaged bulbs rejected before grading. Tulips are usually cleaned by hand as they are easily bruised and damaged. However, shortage of casual labour has meant that on larger units tulips are

Springfields—a show garden for British bulbs

being cleaned mechanically although a limited amount of hand cleaning and separation is still required. Bulbs intended for sale should be clean and of attractive appearance with the outer bulb scale intact and free from cuts and bruises.

Narcissus and tulips are graded according to circumference. The three marketable grades for narcissus are 10–12 cm, 12–14 cm, 14–16 cm and for tulips 10–11, 11–12 and 12–13 cm.

In recent years domestic bulb sales have increased though approximately 70 per cent of bulbs are used in forcing and for field planting. A recent development has been the setting up of growers co-operative organizations through which bulbs are sold to wholesale and retail outlets. Growers in the Spalding area have also developed the bulb display gardens at Springfields, Spalding, which attracts some 125,000 visitors during the flowering period and provides excellent publicity for the industry.

Seed Potato Gangrene

J. M. Proctor

WIDESPREAD experience of gangrene decay in Scottish seed potatoes has led to some loss of confidence in this source of seed and to increased interest in home-produced seed. Examination of the research findings on this disease, and of the practical conditions in the industry, indicates clearly that the trouble arises from the infection of wounds at low temperature. In warm conditions wounds heal sufficiently quickly to keep the organism out, but at low temperatures wound healing is so slow that gangrene entry and development can take place. Gangrene becomes a serious problem largely because most fresh wounds are not visible to the naked eye, and because the disease takes several weeks to develop sufficiently to be seen. This may be long after the seed has left the grower's hands, so that there is no obvious link between cause and effect.

Whenever potatoes are handled some, and perhaps all, will be wounded. The main occasions when seed potatoes are damaged are at lifting, riddling and, to a lesser extent, during transportation and traying-up. That little gangrene is usually seen before riddling is due to the comparatively warm conditions at lifting and in the early weeks of storage when the potato respiration rate is high and they warm up naturally; thus harvest wounds heal comparatively quickly.

An infected potato

Since most seed is required by the English grower long enough before planting for it to be chitted, it is inevitable that riddling, which cannot be started until harvest is finished, must take place when outdoor temperatures have become quite low. Thus, damage may not heal quickly and gangrene have favourable conditions for entry and development unless enough warmth is given. Unfortunately, most seed commences its cold journey to England immediately after cold riddling.

Riddling

The riddles used on many farms are capable of damaging every tuber though most of this damage is not apparent on inspection. A small proportion of Scottish farms go to great lengths to minimize riddling damage, with foam padding everywhere and even underfloor unloading or box storage to help reduce scuffing. Though such measures can cut down damage enormously they are unlikely to prevent it entirely.

It has been demonstrated beyond all reasonable doubt that warming the potatoes before riddling, and holding them in warm conditions for a number of days before despatch to heal wounds quickly, could bring gangrene losses due to riddling down to an acceptable level. About one week at 55°F should be enough to heal wounds; the process takes too long at 45°F. If the potatoes are cold at riddling they may take so long to become sufficiently warm for the wounds to heal that some gangrene is able to enter, even though they go straight from the riddle to a warm room.

In most large stores adequate temperature is unlikely to be attained economically unless the building can be sub-divided into large 'bins'. However, it would not seem too difficult for a relatively small area to be partitioned off for warming the seed for a period immediately after riddling, or for the riddled seed to be held warm in some small adjacent building. A satisfactory

warming room could be made with straw bale walls and polythene sheeting for ceiling and doorway. Small stores can be warmed much more economically throughout the riddling period because of the small proportion of air space relative to potato bulk; this situation could be further improved by storing to a greater height where the building allows. The sacks of riddled seed could remain in the same warm building until wounds are healed and they can be despatched safely. Heaters are, of course, used during riddling in some stores simply to make conditions a little more comfortable for the workers.

A question of persuasion

The basic difficulty of persuading the Scottish grower to improve riddling conditions arises from the fact already mentioned that most riddling damage is invisible and the results not apparent for some weeks. He really never sees what the consequences of damage can be, and 'what the eye does not see . . .' It is naturally very difficult to persuade him of the need to improve riddling conditions if it involves appreciable extra cost and effort. He understands how his field crops are approved or rejected because any faults can be seen quite plainly; the same applies to the inspection of the seed itself as the faults, on which it may be rejected, can be seen. How can a fault be demonstrated where none can be seen and where its consequences, if any, are so largely buffered in the merchanting chain?

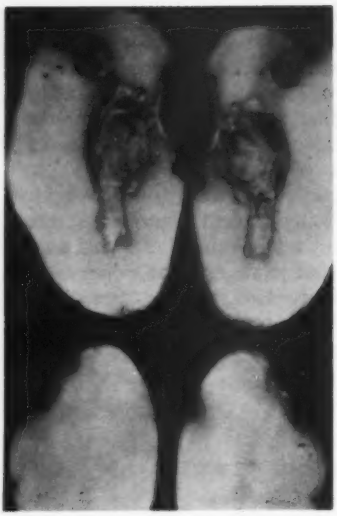
Most growers market through merchants, for convenience and far greater financial security, than by direct farm to farm sales. The merchants appear to accept as a risk of the trade the need to replace occasional consignments; the impression is gained that the grower himself may not always be required to bear the full financial responsibility for any fault. The merchant may, in fact, fairly accept some of the blame where transit has been prolonged.

It has been suggested that post-riddling gangrene development takes place on a sufficient scale in Scotland for growers to be aware of the danger. But, in the first place, it would appear that for home use the seed tends to be riddled out late and is then kept in sacks which seem to give better healing conditions than trays. Also in farm to farm sales in Scotland the journey is shorter, the seed being exposed to cold conditions for a shorter time with probably less transport damage.

Occasionally some gangrene develops in a consignment which has been riddled but has been delayed in despatch due to bad weather; rarely, however, is the delay sufficient to allow really serious decay to occur, but if it does the seed is simply picked over again and dispatched.

Warming

Each time seed is handled it requires warming to heal wounds, but too many warmings make it difficult to control sprout growth. The seed should be warmed immediately on receipt on the English farm; the shorter the time taken on the journey from Scotland the greater the chance of reducing riddling gangrene. If the journey was short, this warming will heal some riddling wounds before gangrene enters; it will also prevent most transport wounds from letting gangrene in and, if traying is done immediately on receipt, traying wounds will be healed at the same time. It is obviously advisable for the English grower to make every effort to tray-up on receipt to avoid an extra warming period.



An infected potato

Since most seed is required by the English grower long enough before planting for it to be chitted, it is inevitable that riddling, which cannot be started until harvest is finished, must take place when outdoor temperatures have become quite low. Thus, damage may not heal quickly and gangrene have favourable conditions for entry and development unless enough warmth is given. Unfortunately, most seed commences its cold journey to England immediately after cold riddling.

Riddling

The riddles used on many farms are capable of damaging every tuber though most of this damage is not apparent on inspection. A small proportion of Scottish farms go to great lengths to minimize riddling damage, with foam padding everywhere and even underfloor unloading or box storage to help reduce scuffing. Though such measures can cut down damage enormously they are unlikely to prevent it entirely.

It has been demonstrated beyond all reasonable doubt that warming the potatoes before riddling, and holding them in warm conditions for a number of days before despatch to heal wounds quickly, could bring gangrene losses due to riddling down to an acceptable level. About one week at 55°F should be enough to heal wounds; the process takes too long at 45°F. If the potatoes are cold at riddling they may take so long to become sufficiently warm for the wounds to heal that some gangrene is able to enter, even though they go straight from the riddle to a warm room.

In most large stores adequate temperature is unlikely to be attained economically unless the building can be sub-divided into large 'bins'. However, it would not seem too difficult for a relatively small area to be partitioned off for warming the seed for a period immediately after riddling, or for the riddled seed to be held warm in some small adjacent building. A satisfactory

warming room could be made with straw bale walls and polythene sheeting for ceiling and doorway. Small stores can be warmed much more economically throughout the riddling period because of the small proportion of air space relative to potato bulk; this situation could be further improved by storing to a greater height where the building allows. The sacks of riddled seed could remain in the same warm building until wounds are healed and they can be despatched safely. Heaters are, of course, used during riddling in some stores simply to make conditions a little more comfortable for the workers.

A question of persuasion

The basic difficulty of persuading the Scottish grower to improve riddling conditions arises from the fact already mentioned that most riddling damage is invisible and the results not apparent for some weeks. He really never sees what the consequences of damage can be, and 'what the eye does not see . . .' It is naturally very difficult to persuade him of the need to improve riddling conditions if it involves appreciable extra cost and effort. He understands how his field crops are approved or rejected because any faults can be seen quite plainly; the same applies to the inspection of the seed itself as the faults, on which it may be rejected, can be seen. How can a fault be demonstrated where none can be seen and where its consequences, if any, are so largely buffered in the merchanting chain?

Most growers market through merchants, for convenience and far greater financial security, than by direct farm to farm sales. The merchants appear to accept as a risk of the trade the need to replace occasional consignments; the impression is gained that the grower himself may not always be required to bear the full financial responsibility for any fault. The merchant may, in fact, fairly accept some of the blame where transit has been prolonged.

It has been suggested that post-riddling gangrene development takes place on a sufficient scale in Scotland for growers to be aware of the danger. But, in the first place, it would appear that for home use the seed tends to be riddled out late and is then kept in sacks which seem to give better healing conditions than trays. Also in farm to farm sales in Scotland the journey is shorter, the seed being exposed to cold conditions for a shorter time with probably less transport damage.

Occasionally some gangrene develops in a consignment which has been riddled but has been delayed in despatch due to bad weather; rarely, however, is the delay sufficient to allow really serious decay to occur, but if it does the seed is simply picked over again and dispatched.

Warming

Each time seed is handled it requires warming to heal wounds, but too many warmings make it difficult to control sprout growth. The seed should be warmed immediately on receipt on the English farm; the shorter the time taken on the journey from Scotland the greater the chance of reducing riddling gangrene. If the journey was short, this warming will heal some riddling wounds before gangrene enters; it will also prevent most transport wounds from letting gangrene in and, if traying is done immediately on receipt, traying wounds will be healed at the same time. It is obviously advisable for the English grower to make every effort to tray-up on receipt to avoid an extra warming period.

The buyer must influence the seed grower

Apart from the reduction in gangrene which the buyer can achieve by warming up the seed immediately upon receipt, the purchaser himself can have the greatest influence on the techniques of the seed grower. It is essential that he should know accurately what to demand. At least one Scottish supplier will guarantee to supply seed which has received adequate warmth after riddling.

It has been not uncommon practice for the more progressive English growers to visit Scotland during the growing season to see the crops from which they intend to purchase seed. In view of the stringent and improving virus control techniques this trip is largely unnecessary; a visit during riddling would seem a much more effective way of reducing the gangrene problem. With a good understanding of the behaviour of the gangrene organism it requires only a commonsense examination of the seed holding and riddling conditions to assess whether the produce will be reliable; the presence or absence of temperature records is a good guide in itself. Preferably the building holding the seed should have an insulated roof, certainly all riddled seed must be found to be well strawed and covered with a sheet; this, besides helping increase the temperature, will tend to increase humidity which also helps the healing process. If the riddling gang are in their shirt sleeves this also promises well; if each wears more than four sweaters it would seem wise to buy elsewhere!

It would seem that direct farmer to farmer movement of seed is most likely to ensure satisfaction and could be encouraged, although monetary security equal to that provided by his merchant must be provided to the seller. Growers should be encouraged to make use of the Scottish Register of Certified Crops, either to facilitate direct purchasing or, when purchasing through merchants, to enable them to order seed from sources which have proved to be good in the past, making use of the grower farm code number which must appear on a label or on the container.

New techniques

This year sees the commencement of the development of new techniques in the Scottish seed industry for the production of gangrene-free stocks using stem cutting and fungicides. This system will take a number of years to prove itself. It *could* make redundant the whole concept of quick wound healing for minimizing gangrene infection, but it is worth remembering that surgeons still wash their hands before operating in spite of the range of antibiotics on the shelf beside them!

This article has been contributed by **J. M. Proctor, B.Sc.**, a Crop Husbandry Adviser with the National Agricultural Advisory Service at Regional Headquarters, Cambridge. In company of several colleagues, and with the co-operation of advisers at Scottish Colleges, he has made a study of seed production conditions in the north of Scotland over three recent winters.

Since 1738 a stately home has been situated in Wharfedale in the West Riding of Yorkshire among some of the most beautiful scenery in this country

The Harewood Estate

G. E. M. Hildred

LEEDS and Bradford together conjure up in the imagination clothing factories and woollen mills in profusion interspersed with other industries—and the homes of nearly one million people. Yet within three miles of the city boundary of Leeds is some of the most beautiful scenery in the country.

The Harewood Estate in Wharfedale consists of 5,300 acres and adjoins the River Wharfe. The Lascelles connection with Harewood began in 1738 when Henry Lascelles of Northallerton bought the old mansion of Gawthorpe Hall which stood at the north-east corner of the present lake. Eventually, a new house on the hill was built by his son Edwin, who commissioned John Carr of York to design Harewood House and village. In 1755, his design accepted, he began to build the new model village which is now divided by the main Leeds/Harrogate road and the foundation stone for the new house was laid in January 1759. During the same year the rising Scottish architect, Robert Adam, was consulted over the restoration of Harewood Church and there is no doubt that his opinion of Carr's plans was requested. The patron was influenced by Adam's ideas and continually interrupted progress to incorporate Adam's modifications and changes and it is definite that Adam was responsible for the interior of the house. The timbered park, lake and beautiful landscape were created by the master of the picturesque, 'Capability' Brown, who was paid £6,000 for his efforts.

The house was at last occupied in 1772 when it earned fame up to the Great War as one of England's great country palaces—a centre of political as well as social life in Yorkshire. The heirs were interested in sport, hunting and the quiet enjoyment of the broad acres of rural life.

Changes

The Great War brought the first major changes with the house becoming a hospital and a new interest in commercial forestry and outlook towards improvements began to take shape. The 6th Earl married the Princess Royal in 1922 and he inherited the estate in 1929; they came to live at Harewood in the early thirties. Both knew the country life and a substantial programme of constructive development commenced—new and existing woods and gardens were developed, a stud farm was built as well. The Second World War put an end to these improvements and once again the house became a hospital and the estate continued to grow food as best it could with a depleted staff.

The buyer must influence the seed grower

Apart from the reduction in gangrene which the buyer can achieve by warming up the seed immediately upon receipt, the purchaser himself can have the greatest influence on the techniques of the seed grower. It is essential that he should know accurately what to demand. At least one Scottish supplier will guarantee to supply seed which has received adequate warmth after riddling.

It has been not uncommon practice for the more progressive English growers to visit Scotland during the growing season to see the crops from which they intend to purchase seed. In view of the stringent and improving virus control techniques this trip is largely unnecessary; a visit during riddling would seem a much more effective way of reducing the gangrene problem. With a good understanding of the behaviour of the gangrene organism it requires only a commonsense examination of the seed holding and riddling conditions to assess whether the produce will be reliable; the presence or absence of temperature records is a good guide in itself. Preferably the building holding the seed should have an insulated roof, certainly all riddled seed must be found to be well strawed and covered with a sheet; this, besides helping increase the temperature, will tend to increase humidity which also helps the healing process. If the riddling gang are in their shirt sleeves this also promises well; if each wears more than four sweaters it would seem wise to buy elsewhere!

It would seem that direct farmer to farmer movement of seed is most likely to ensure satisfaction and could be encouraged, although monetary security equal to that provided by his merchant must be provided to the seller. Growers should be encouraged to make use of the Scottish Register of Certified Crops, either to facilitate direct purchasing or, when purchasing through merchants, to enable them to order seed from sources which have proved to be good in the past, making use of the grower farm code number which must appear on a label or on the container.

New techniques

This year sees the commencement of the development of new techniques in the Scottish seed industry for the production of gangrene-free stocks using stem cutting and fungicides. This system will take a number of years to prove itself. It *could* make redundant the whole concept of quick wound healing for minimizing gangrene infection, but it is worth remembering that surgeons still wash their hands before operating in spite of the range of antibiotics on the shelf beside them!

This article has been contributed by **J. M. Proctor, B.Sc.,** a Crop Husbandry Adviser with the National Agricultural Advisory Service at Regional Headquarters, Cambridge. In company of several colleagues, and with the co-operation of advisers at Scottish Colleges, he has made a study of seed production conditions in the north of Scotland over three recent winters.

Since 1738 a stately home has been situated in Wharfedale in the West Riding of Yorkshire among some of the most beautiful scenery in this country

The Harewood Estate

G. E. M. Hildred

LEEDS and Bradford together conjure up in the imagination clothing factories and woollen mills in profusion interspersed with other industries—and the homes of nearly one million people. Yet within three miles of the city boundary of Leeds is some of the most beautiful scenery in the country.

The Harewood Estate in Wharfedale consists of 5,300 acres and adjoins the River Wharfe. The Lascelles connection with Harewood began in 1738 when Henry Lascelles of Northallerton bought the old mansion of Gawthorpe Hall which stood at the north-east corner of the present lake. Eventually, a new house on the hill was built by his son Edwin, who commissioned John Carr of York to design Harewood House and village. In 1755, his design accepted, he began to build the new model village which is now divided by the main Leeds/Harrogate road and the foundation stone for the new house was laid in January 1759. During the same year the rising Scottish architect, Robert Adam, was consulted over the restoration of Harewood Church and there is no doubt that his opinion of Carr's plans was requested. The patron was influenced by Adam's ideas and continually interrupted progress to incorporate Adam's modifications and changes and it is definite that Adam was responsible for the interior of the house. The timbered park, lake and beautiful landscape were created by the master of the picturesque, 'Capability' Brown, who was paid £6,000 for his efforts.

The house was at last occupied in 1772 when it earned fame up to the Great War as one of England's great country palaces—a centre of political as well as social life in Yorkshire. The heirs were interested in sport, hunting and the quiet enjoyment of the broad acres of rural life.

Changes

The Great War brought the first major changes with the house becoming a hospital and a new interest in commercial forestry and outlook towards improvements began to take shape. The 6th Earl married the Princess Royal in 1922 and he inherited the estate in 1929; they came to live at Harewood in the early thirties. Both knew the country life and a substantial programme of constructive development commenced—new and existing woods and gardens were developed, a stud farm was built as well. The Second World War put an end to these improvements and once again the house became a hospital and the estate continued to grow food as best it could with a depleted staff.

With the end of the war thoughts turned to making further improvements but, unfortunately, in 1947 the 6th Earl died aged 65 and the present Earl, having not long returned from a prison camp in Germany, came into possession of the estate of nearly 20,000 acres.

With the heavy estate duty to meet, some 14,000 acres of land was sold. The accumulation of repairs to the remainder of the estate had to be dealt with and the question was, could Harewood House continue to be the family home?

Order was eventually restored and it was important to run the estate on commercial lines to give maximum income which could be used to maintain the fabric and contents of the historic house. Certain methods presented themselves:

to repair and improve the estate property, farms, houses and cottages, which were left; to maintain and improve the rent, and increase the capital value;

to open the house to the public; develop the gardens to sell roses, shrubs etc; use the park for large outdoor events, increase income from sporting rights;

to dedicate the woodlands and develop the sawmill commercially;

to realize some of the buildings and land to provide capital for estate improvements; reduce overheads (staff, machinery, fuel etc. costs);

to develop the Home Farm.

All these proposals were put in hand and the estate is now a thriving concern.

The Estate today

The estate now comprises some 5,300 acres of which 2,750 acres are tenanted and 1,404 acres form the Home Farm. The remainder of the land amounts to about 300 acres which includes property in the village—petrol station, village Inn and several residential houses.

The woodlands cover some 900 acres all of which are dedicated under the Forestry Commission Scheme. Well above 50 per cent of this acreage is under thirty years old, mainly because in the gales of 1962 some 20,000 trees were blown down in two days and had to be replanted. There is a sawmill run on a commercial basis with an annual output of some 180,000 cubic feet; ninety per cent of the timber processed is sold.

The gardens cover eight acres and are devoted to roses and shrubs on a commercial scale. A large Garden Centre development is in progress.

The estate employs a total staff of eighty-three, increased by twenty-two during the summer when the estate is thrown open to the public.

A large repair programme has also been undertaken and some forty-five cottages have been reconditioned, nearly all with a local authority grant to provide an extra bedroom, bathroom and W.C. Repairs to roofs and general property on homesteads have also been carried out.

The decision to improve the tenanted holdings and the Home Farm virtually coincided with the introduction of grant under the Farm Improvement Scheme; thus a large number of the improvements have received assistance. At the same time, the Agent realized that an improvement in the size of holdings would be necessary so that economic returns for tenants and rents for the landlord would be forthcoming.

A sign of this trend is that there were some twenty-seven holdings in 1957 whilst today there are seventeen plus the home farm—eight of these are in the latest sale. One tenant came on to the estate in the early '50s as the occupier of a 110-acre holding; four further holdings have since been added to make up his unit to 810 acres. Such an amalgamation presupposes that a radical reorganization of the buildings has taken place. After considerable discussion and thought it was decided to concentrate on two main blocks based on two of the existing homesteads. At one, a grain store, a dairy installation for 120 cows (including a fourteen-stall seven-unit herringbone parlour), a nine-bay fold-yard 135 ft × 50 ft and a Dutch barn were erected. At the other, young stock accommodation, implement housing and a pig fattening house for 300 fatteners were built. Similar undertakings on two further large units created in the period involved comparable capital expenditure and now form 356 and 306 acre holdings respectively instead of the original 99 and 258 acres.

The Home Farm

The original Home Farm comprised 800 acres but has grown by amalgamation over twelve years to 1,404 acres, incorporating in the process six holdings varying in size from 40 to 130 acres. This acreage includes the 350 acre park attached to Harewood House. The considerations which exercised everybody when the decision to modernize was taken, were certainly unusual. Time and distance figure prominently; the opening of the house to the public, the concentration of Canada Geese on the lake and their depredations on grassland, Yew poisoning, and woodland fencing with 100 or more gates are problems not found on the average farm. A pedigree Red Poll herd was in existence, and other cows Red Poll x Danish Red and Ayrshire; sheep, pigs and a commercial beef herd were also kept. These arrangements were simplified by dropping single suckling of beef, increasing the corn acreage and eventually by drastically increasing the dairy herd and concentrating the pig breeding in one set of buildings. Thus by 1964 the cropping was some 400 acres of corn, 25 acres of kale, 99 acres of temporary grass and 428 acres of permanent pasture. In 1963, as a first step, a six-bay timber and asbestos building 90 ft × 40 ft with 8 ft high precast reinforced walls was erected to provide loose grain storage and house a drier and mill mixing and cubing machine. The excess grain is being stored loose in the old stables. As a medium term expedient in 1959 an existing implement shed was converted to a dairy, six-stall abreast parlour and collecting yard; this allowed an increase both in herd size and efficiency as milking at that point of time was in a number of cowsheds.

The pig breeding herd of seventy sows was already established in a range of buildings known as Village Farm, the fattening being undertaken in sundry buildings converted for the purpose on a number of holdings. To avoid the transfer of pigs, feed movement etc. to a marked degree, a 26-pen fattening house with slatted floor dung channels was built.

In 1966 there was a major step forward. A 130-acre holding became vacant and was taken in hand. Whilst tenanted, a Farm Improvement Scheme had been carried out to provide housing for some 60 cows in a steel and asbestos fold-yard 75 ft × 70 ft together with a six-stall tandem parlour and dairy converted from an existing building. The facilities provided the opportunity to move the Red Poll herd and the one-man unit created is working very satisfactorily.

This left the main homestead with no dairy enterprise and bearing in mind the problems it was decided to establish a 250-cow unit based on the Friesian breed and zero-grazing. Such an enterprise called for much thought and a three-phase scheme was decided upon which took account of the time of year. Phase one was the provision of three 22 ft diameter × 65 ft high silos for grass conservation and one 18 ft × 55 ft high moist grain silo, including all ancillary equipment. Phase two provided cow accommodation and the parlour building, comprising a three-span cubicle house 140 ft × 147 ft and the parlour, dairy and collecting yard. Phase three included all the building work, parlour fittings, twenty-four-stall herringbone and two 400-gallon bulk milk tanks. This undertaking was completed in the autumn of 1967, but was slowly off the ground due to the foot-and-mouth disease outbreak and the long period of difficulty in obtaining cows. Today, the cropping of the 1,404 acres Home Farm is 200 acres wheat, 480 acres barley, 25 acres kale, 197 acres rough grazing, 200 acres ley and 302 acres permanent grass. The stock on the farm comprises 280 Friesians and cross breds, 60 Danish Red cross, 300 ewes, a 125 sow herd at the Village Farm and a 100 sow herd at Moorfield Farm. All calves are reared, steers being sold off fat.

Future Attractions

The opening of the house and grounds to the public has been steadily expanded over the years and in 1969 attracted 140,000 visitors. A bird garden covering three acres of land adjacent to the lake has been completed as an additional attraction.

In the bird garden some thirty-six large aviaries, including a tropical house, have been constructed. A great many of the inmates will be free flying and the public will be able to walk among them. Some 200 varieties of exotic birds are to be housed, including penguins, flamingoes, toucans, parrots and humming birds.

The estate has seen many vicissitudes since 1738 and has certainly diminished in size due to taxation. Nevertheless, anyone visiting this famous estate will see that the will to survive is paramount and no stone will be left unturned to achieve that end.

This article has been contributed by **G. E. M. Hildred, F.R.I.C.S., A.A.I.,** who is a Senior Assistant Land Commissioner with the Agricultural Land Service in the Yorkshire (West Riding) Divisional Office.

A Warning to Bulb Growers

Bulb Dipping with Organomercury Compounds

Bulb growers are warned of the risks of using organomercury bulb dips.

Organomercury preparations are perfectly odourless in use and one of their main dangers is that the effects of poisoning are not immediately apparent. Persons exposed to vapour from the dips or whose skin is contaminated by the liquid may suffer from damage to the nervous system and the kidneys. Apart from the suffering involved, the poisoning is often irreversible and can result in permanent incapacity for work.

Because of these dangers, organomercury bulb dips should only be used in premises registered under the Factories Act where regular expert inspection can ensure that the right precautions are taken against a build-up of concentrations of mercury in the atmosphere, that the processes used are safe, and that proper protective clothing is worn.

Advice on other less hazardous methods of bulb dipping may be obtained from the National Agricultural Advisory Service.

This year is also the 21st anniversary of the founding of this organization which is essentially concerned with the way that land is used and managed

The Nature Conservancy

Dr. P. A. Gay

THIS year is European Conservation Year, the most ambitious international programme yet promoted to make all Europeans aware of the importance of their natural environment and the need for its care and conservation—a programme with which the Nature Conservancy is intimately concerned. For the Conservancy, it has an added significance—the twenty-first anniversary of its founding.

On 23rd March 1949 the first sixteen members (The 'Board of Governors') received their Royal Charter which brought the Nature Conservancy into being alongside the other research organizations, the Department of Scientific and Industrial Research and the Agricultural and the Medical Research Councils. In 1965, as part of the re-organization of government civil science, the Conservancy was incorporated into the newly-formed Natural Environment Research Council together with such bodies as the then Geological Survey, but it has retained its identity as the official body concerned with nature conservation. It is financed solely by Treasury grant in aid (through N.E.R.C.) on the vote of the Department of Education and Science, and its powers derive through the Council both from the Royal Charter and from various Acts of Parliament. It has three main functions: to establish and manage nature reserves; to advise and disseminate knowledge concerning nature conservation; and to carry out and support research appropriate to these activities. All these aspects are very closely inter-related as will be seen in this article.

Organization of the Conservancy

Britain is divided into eleven regions, each under the authority of a Regional Officer responsible for organizing an integrated advisory service and for the management of the nature reserves within his region. The research work is organized separately and is centred on the eight research stations under the control of Station Directors. Nature reserve managers and scientific advisers need the specialist support of their research colleagues, who likewise are influenced in their choice of projects by the types of problems that are being experienced on the reserves and in advisory work. A bridge is provided by representatives of research workers and those in

regional work developing a partnership in what are known as Habitat Teams. Meetings of these teams are expressly to exchange views and information on fresh problems that are coming forward and need research for their solution, and on the fruits of recent research that can be applied in practical situations.

National nature reserves

The Conservancy is perhaps most widely known because of its 128 nature reserves scattered over the length and breadth of Britain, covering just over a quarter of a million acres. Their purpose is to secure the best representative samples of all the major habitat types such as heathland, sand-dunes, woodland and mountain vegetation. Mankind has progressively influenced the landscape of Britain and few truly natural areas remain, so the reserves reflect to a greater or lesser degree the effect of past management. None the less they are of great interest but it also means that on most nature reserves management of the land must continue. For example, the rich flora of the chalk downlands results from a long history of grazing and to maintain that interest grazing should be continued. The old idea that reserves can be fenced off and left to nature is true in Britain in only a remarkably few instances.

Nature reserve management uses the same techniques as for other land, but the objectives are mostly different. The reserves have many values: as examples of habitats of interest as a part of our cultural heritage; where biological research and studies of living creatures in natural surroundings can be carried out secure from interference or time limits; they afford opportunities for the education of children and adults in nature at work; and they provide a fund of experience to guide advisory work (considered more fully below).

These are but some of the more important aspects, the success of which cannot be measured solely in financial terms. We are always seeking practical ways of doing old jobs more efficiently, but there are occasions when we must continue systems of management that are going out of agricultural use; zero-grazing for example, is unlikely to be a practical way of maintaining a rich sward on the steep downs. Most national nature reserves can be visited by the public provided a permit is obtained, and several are quite freely accessible without any formalities. This is not always possible: for example, when a reserve has been established for intensive research which could easily be damaged by visitors; areas of high fire risk need great care; and where a reserve is a partnership between the Conservancy and the owner or occupier the wishes of the latter must of course be respected. Such a partnership is arranged by a special form of legal agreement, a Nature Reserve Agreement; the Conservancy is allowed certain rights such as conducting research, but the normal land management continues much as before. This form of reserve covers about 60 per cent of the acreage of reserves in Britain and has been particularly effective on hill grazing and marginal land; the remainder are held on lease or are owned.

Research

Ecology, that part of science which seeks an understanding of the complex inter-relationships between plants, animals and the sites and conditions under which they live, is the basis of the Conservancy's functions. Although current work includes various fundamental studies, the emphasis is on projects that have application to the practical problems encountered both in

managing the nature reserves and experienced by all concerned with wildlife conservation. There are studies on the effect on downland sward composition of grazing at different seasons of the year so that we can more accurately prescribe what management must be carried out to meet our objectives. Extensive work on deer populations on the Isle of Rhum and their relation to the vegetation has led to an appreciation that in such places venison produces a better return on the land than sheep grazing. Some of the most well-known work has been done by the Toxic Chemicals and Wildlife Division at Monk's Wood Experimental Station on the effect of some of the persistent pesticides such as dieldrin and aldrin on wildlife, and on the previously unsuspected wide effects of their accumulation through food chains. Predatory birds have been seriously affected by the persistent organochlorides although the pesticide was directed at a quite different target.

Work in universities supported by research grant from the Conservancy is, by contrast, seldom orientated towards immediate and practical problems; normally it is on more fundamental ecological questions and provides the basic understanding of the underlying scientific principles. It is not to be judged on its immediate practical advantage to mankind, but on its scientific excellence and in the realization that such fundamental knowledge does in many cases lead in the long term to major practical advances.

Support for research is given in other ways. The nature reserves provide secure sites for much of the research, and special management schemes are often devised to provide conditions needed by research workers not possible on agricultural land. In addition, the Conservancy issues licences to take specimens for research, which would otherwise be illegal under, for example, the Protection of Birds Acts.

Advice on conservation

Conservation of all that is worth while in Britain could not succeed if confined to national nature reserves. These form only half a per cent of the land of Britain; yet there is much of great value scattered throughout the countryside. One statutory duty of the Conservancy is connected with sites of special scientific interest; these number just over 2,000, vary from glacial erratic Boulders, an indication of the past extent of the Ice Ages, to wide tracts of mountain country, and can be regarded as next in importance to the national reserves. Local Planning Authorities are notified of such sites and the Conservancy's views are sought on any development proposals. In most cases the areas are marginal agricultural land or under less intensive agricultural use, but the Conservancy takes seriously its duty towards the needs of agriculture and forestry. However, these sites give the Conservancy no rights other than to be consulted by the Planning Authority; of course, the planners have other needs and considerations to take into account, so that the Conservancy's advice is in no way over-riding. In many cases, however, it is possible to safeguard features of conservation interest, often by devising practical compromises; the number of occasions on which out and out opposition to a scheme is the only way to protect the scientific interest are very few. In any case, the Conservancy relies to a very great extent on the goodwill of the occupier.

There is a growing appreciation that nature conservation ideals can be incorporated widely throughout the countryside and the Conservancy's advice is increasingly being sought on conservation matters well outside sites

of special scientific interest. One particularly interesting aspect is the advice requested on integrating wildlife conservation with recreation—it is now widely recognized that native animals and plants of the countryside are part of what people at leisure wish to see. The skill, however, is in finding how to let people see wild nature without destroying the very thing they wish to see. In so many aspects of the advisory work the Conservancy must seek answers to its problems by finding ways of integrating nature conservation with other land uses rather than by dividing the land into separate compartments.

In its advisory work the Conservancy can draw upon the fund of scientific knowledge provided by research as well as its practical experience in managing its own national nature reserves. Many of the problems where our advice is sought are variations of those that we have had to overcome in a practical way on our own properties.

Conservation and social purpose

Nature conservation is essentially concerned with the way land is used and managed, and the success of the Conservancy's work depends to a very great degree on influencing people to make a wise use of the wildlife and natural resources of the country—to be wise before changes are made rather than to repent in retrospect. Besides maintaining official links with other government bodies such as the Countryside Commission and the Water Resources Board, the Conservancy has kept in close touch with voluntary organizations operating in the field of conservation, particularly the County Naturalists' Trusts, because they can provide a focus for action by the informed public and have played a great part in creating the general awareness that there now is of the problems of man's environment. Nature conservation grew out of a Victorian interest in natural history, but today takes a much wider view. It is a major part of the Conservancy's role to see that the lessons of the past and the knowledge from research in ecology are used to help in guiding the country in the wise future use of the land. It is an example of science at the service of mankind.

This article has been contributed by **P. A. Gay, B.Sc., Ph.D., M.I.Biol.**, Regional Officer of the Nature Conservancy's South West Region, Roughmoor, Bishop's Hull, Taunton, Somerset.

MEAT AND LIVESTOCK COMMISSION

Appointment of Chairman

The Minister of Agriculture, Fisheries and Food, the Secretary of State for Scotland and the Secretary of State for Wales have re-appointed Sir Rex Cohen, K.B.E., to be Chairman of the Meat and Livestock Commission for a further year until 30th September, 1971.

Living Grain

G. T. Bills

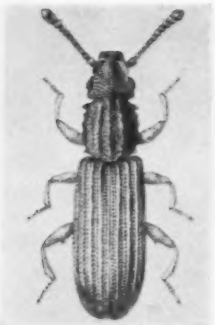
FARMING enterprises are now, more than ever before, subject to close scrutiny to improve gross margins per acre. Cereal growing is no exception. Wherever cereals are grown, cultivations are timed and seed selected, standing corn tended and examined during growth: all with considerable care to achieve maximum production.

Less care, however, is generally taken of this valuable grain, the sum total of all production efforts, once it has been put in store. There it is likely to deteriorate if conditions are unsuitable, and neglect at this stage can prove costly and particularly disruptive if the damage is not discovered in time. This, the final hazard to cereal growing, does not perhaps receive the attention it deserves and continues to take its toll every season. Trouble can be avoided if it is remembered that grain in store is still *living* grain, responsive to storage conditions. It should be treated accordingly. Successful storage depends on an understanding of the factors that affect grain in store and this article presents the main points deserving consideration.

Physical factors

Temperature is the most important. Grain is a poor conductor of heat and any residual warmth from the drier's operational temperature of 66°C (151°F) for milling wheat, for example, will remain trapped in the bulk, dissipating only extremely slowly. Any temperature above 17°C (63°F)

Grain weevil
(actual length $^{1}/_{10}$ in.)



Saw-toothed grain beetle
(actual length $^{1}/_{10}$ in.)

Rust-red grain beetle
(actual length $^{1}/_{12}$ in.)

provides suitable breeding conditions for that most troublesome insect pest, the saw-toothed grain beetle (*Oryzaephilus surinamensis*). From the accumulating warmth of their own metabolism, these insects will initiate and accelerate grain heating, introducing in addition the hazards of cross-infestation to near-by bulks. If, as happens at harvest time, grain is warmer than it should be when placed into a bin, it is all the more important that the temperature of this bulk should be closely watched. In general, if there is no temperature rise over a few weeks the bulk may be expected to cool, only extremely slowly, provided no insects are present and the grain is sufficiently dry.

Adequate cooling after drying is, therefore, a most important safeguard in preventing heating problems later on, but is often overlooked or considered of little consequence. Few driers have really effective cooling sections; many cannot cope when running at maximum capacity during peak periods and many older installations are required to handle grain production well exceeding their capacity. It is under such conditions that the merits of storage aeration systems are so attractive where, after drying, grain can be cooled at leisure without further movement. Maximum control over the future behaviour of a grain bulk during drying will be gained from careful measurement rather than guesswork. A watch on the hot air temperature used should be kept by checking the burner setting against the drier thermometer, which itself can be checked by putting a reliable mercury thermometer into the airflow.

Once in store, weekly temperature checks will determine whether the bulk is gradually cooling or heating. Experienced grain handlers know that first suspicions are aroused often from merely walking over the grain surface, when a barely perceptible degree of resistance to the feet sinking in is an indication of possible build-up below the surface which needs investigation. A useful rough guide to the onset of heating deep in a bulk is given by grasping the protruding six inches of a quarter-inch diameter iron rod which has been pushed vertically down the centre of a grain bulk and left permanently in position. Mercury bulb thermometers take about half an hour before settling to give an accurate figure and the quickest, most accurate results are given by probes with thermistor sensor tips. It is more important, however, to

ensure that *regular* checks are made on the condition of this valuable end-product rather than make infrequent precision temperature measurements.

Moisture content of grain also has an important bearing on its behaviour in store and maximum levels have been determined for safe long-term and short-term storage. To exceed these levels is to risk the onset of heating, whether insects are present or not. In the absence of insects, grain heating stems from the increased metabolism of fungal mycelium, all grains being infected with fungal spores which are activated by damp conditions. The activity of these moulds can be restrained by treatment with proprionic acid, as is done when storing wet grain for animal feed, but this treatment is unsuitable for grain other than for animal feed.

Although storage at the lower moisture contents is safer over longer periods, the trade generally requires cereals, other than barley for malting, at 16 per cent moisture content. This minimizes the farmer's drying costs and suits the flour miller who conditions his wheat to mill at 15–15½ per cent. For the farmer, however, working at this upper limit of 16 per cent does mean that there is a negligible margin for error and moisture measurements must be accurate. Moisture meters should be used frequently as a guide to setting the drier, and they should be recalibrated regularly for accuracy. Mistakes in the use of a moisture meter can result in storage at the wrong moisture content.

Conclusions drawn from correctly read moisture contents may still be misleading if the samples from which they were obtained are not truly representative of moisture conditions throughout the bulk. The use of a grain sampling spear, with the shaft marked to show the depth of sampling, is a necessity. This close control over the grain's moisture content is a financially sound exercise because it enables the cereal grower to achieve maximum return from his product on a weight basis, while avoiding the costs he could face in dealing with heating problems of damp grain. Where grain has to be supplied at 16 per cent moisture content, for example, deliveries over this figure incur extra drying charges for the supplier; the farmer supplying grain at 15 per cent, on the other hand, penalizes himself to the extent of the value of one ton of grain in every hundred. It is because of such factors that the installation costs of an automatic control system for precision conditioning of grain are soon recovered, particularly in large scale grain stores.

Aeration. The provision of airflow through a bulk is the last major factor for consideration. This is the only means of controlling the environment within the bulk without moving the grain and can be invaluable in combating heating when grain has to be accepted in poor condition. The principal aim is to reduce temperature without raising the moisture content. There are several ways in which the principle is applied, all of them providing control over the grain *in situ*, formerly restricted to the owners of purpose-built ventilated bins. The alternative, turning grain to cool it, is dependent on an empty bin being available to turn it into; also if insect infestation is present it will be spread, resulting in added expense. Installations providing aeration cooling need not be all that costly. Semi-permanent weldmesh/hessian silos can be equipped with blowers; on-floor grain driers operate on this principle. There is an even more recent development which brings this technique to the many farms already equipped with solid floor, metal

silo bins. Here, an air duct is introduced through the side at the base of a bin, and a small fan is bolted to the flange outside the bin. Grain temperature is kept low, at minimal running costs, and the fan can be switched to any bin. The outlay for the fan and air duct is approximately £50 and £10 respectively.

Grain deterioration

As a result of heating, be it damp or insect induced, the condition of grain in a bulk deteriorates, resulting in caking, further condensation and eventual sprouting on the surface. Such grain will be rejected for malting or milling. Certainly, where insects have attacked the germ, the sample will be unsuitable for seed or malting. In addition, quite apart from any deterioration customers quite rightly do not want insects and the problems they bring with their grain. This is particularly the case for malting barley. Internationally, insect-free grain has been demanded and supplied to certain countries: in this country, the farming industry should be working towards this objective.

Insects

The chief insect pests attacking grain are the saw-toothed grain beetle (*Oryzaephilus surinamensis*), the grain weevil (*Sitophilus granarius*) and the rust-red grain beetle (*Cryptolestes ferrugineus*). These are only found in store where they can overwinter. They are introduced to farms on empty sacks, animal feed, grain for contract drying or grinding, borrowed equipment and so on. Cereal growers should be able to recognize these three pest species; any others are likely to be less important, possibly harmless. Such knowledge can decide if there is a serious insect problem, and whether a load needs turning back or the expense of chemical treatment is justified.

The flour mite (*Acarus siro*) is much smaller than the insects and, therefore, less noticeable. It attacks the germ of grain and in large numbers can taint wheat sufficiently to make it unfit for milling. Heavy infestations make animal feed unpalatable and can cause digestive disorders.

Control of insect infestation is possible by fumigation applied in liquid or tablet form. Usually ethylene dichloride/carbon tetrachloride mixture or tablets of aluminium phosphide are used. Fumigation is likely to be satisfactory only if the surface of the grain is level, and it should be supplemented by spraying the store itself with a contact insecticide to kill insects outside the area fumigated. Current techniques are explained in Advisory Leaflet 368* and the Ministry's Bulletin 149†. Controlling an infestation is some twenty times as expensive as taking preventative measures.

Prevention. At pre-harvest cleaning of the grain plant, a sharp look-out should be kept for grain insects. The more thorough the cleaning, the more effective will be the protective spraying that follows. Farmers who have experienced saw-toothed grain beetle infestations invariably spray their empty grain stores before each harvest as an insurance against a recurrence. All grain which comes to the farm should be inspected on arrival and, if possible, stacked away from home grown grain. Any grain found infested should be rejected.

Grain infestation problems are not inevitable, and the discovery of an infestation in an advanced stage of development in a bulk of grain which has

been in store for several months is really a reflection on the cereal grower's care of his product. Assistance on any aspect of this problem can be obtained from Regional Offices of the Ministry.

This article has been contributed by **G. T. Bills, B.Sc.(Agric.)**, who is a stored products entomologist with the Ministry's Infestation Control at Ipswich, Suffolk. He is a specialist in insecticide application equipment.

(Single copies of the following Advisory Leaflets are obtainable free from the Ministry (Publications), Tolcarne Drive, Pinner, Middlesex HA5 2DT).

Heating of Grain in Store A.L. 404

**Insects and Mites in Farm-stored Grain* A.L. 368

†Ministry of Agriculture, Fisheries and Food, Bulletin 149, *Farm Grain Drying and Storage*. Price 13*s*. (by post 14*s*.) from H.M.S.O. (*addresses on p.* 396)

The Ministry's Publications

Since the list published in the July, 1970 issue of *Agriculture* (p. 333) the following publications have been issued.

MAJOR PUBLICATIONS

BULLETINS

No. 199. Low Cost Dairying. (Revised) 6*s*. (by post 6*s*. 4*d*.)
(SBN 11 240499 0)

No. 206. Swarming of Bees. (New) 4*s*. 6*d*. (by post 4*s*. 10*d*.)
(SBN 11 240506 1)

F.E.F. LEAFLET

No. 1. Cowhouses. (Revised) 3*s*. 6*d*. (by post 3*s*. 10*d*.)
(SBN 11 240541 X)

FREE ISSUES

ADVISORY LEAFLET

No. 539. Efficient Milking. (Revised)

SHORT TERM LEAFLETS

No. 72. Weed Control in Horticulture Brassicas. (Revised)
No. 73. Chemical Weed Control in Onions and Leeks. (Revised)

POSTERS

Fireblight on Apple, Pear and Hawthorn. (New)
Colorado Beetle. (New)

Priced publications are obtainable from Government Bookshops (Addresses on p. 396) or through any bookseller. Single copies of the free leaflets are obtainable from the Ministry of Agriculture, Fisheries and Food, (Publications), Tolcarne Drive, Pinner, Middlesex. HA5 2DT.

Hops provide the bitter flavour and act as a preservative to British beer. Today nearly all the crop is machine-picked but traditional hand-pickers may still be found in one or two gardens, recalling the days before mechanized farming

British Barley

for British Beer

P. H. T. Evans

In 1969 Britain's 200-odd breweries produced some 32·9 million barrels of beer—or about 9½ thousand million pints. It was the industry's highest output for just on fifty years and represented consumption at about twenty gallons per head of population.

The importance of this to the farmer cannot be over emphasized, for the main ingredients of British beer are today as they have been for centuries—home-grown barley and hops.

It is roughly estimated that on average a quarter pint of barley malt and six hops go into the making of every pint of beer. More accurate, and impressive, are the bulk statistics. British beer is mostly made from home-grown products (about 10 per cent of the hops used are imported for use in the brewing of some lagers), and every year approximately 16 million cwt of home-grown malting barley and 200,000 cwt of hops are used in its production.

We live now in an age of automation, when modern breweries are controlled by men in clinically white overalls standing at mighty consoles, watching coloured lights flicker on and off and needles quiver on countless dials; but the basic brewing process has remained unchanged for over 500 years—since the introduction of hops to this country in the middle of the fifteenth century.

Before this, it is worth mentioning, the 'ale of old England' was made simply from barley malt, flavoured with a variety of herbs as, it would seem, the fancy took the brewster (for it was women who mostly did the brewing) of the day. With the introduction of hops from the Continent to act as a flavouring agent and a preservative, a new drink was introduced to Britain—'biere'. The difference between 'ale' and 'biere' existed for many years, but eventually beer, the bitter, hopped drink, finally captured all tastes. Today, of course, the two terms are synonymous and all beers contain hops in varying degree.

Barley gives beer its strength and the hops provide the characteristic bitter flavour. Generally speaking, brewers seek malt made from barley with a low to medium nitrogen content, and although malting barley is grown elsewhere, the main areas are Norfolk, Suffolk, Cambridgeshire, Lincolnshire, parts of Yorkshire, Kent and Hampshire.

Malting

Malting is the first step in the brewing process, when the malt is produced by soaking the barley in water, thereby causing it to germinate. It is during this germination stage that certain changes occur in the grains which ensure the ultimate production of simple sugars vital to the production of beer.

When germination is complete and the grain has produced rootlets, it is transferred to a kiln, dried, cured and the rootlets removed. Malt is very similar in appearance to the barley from which it is derived, but it is friable, with a slightly sweet taste not unlike biscuit.

The value of malt to the brewer depends to a considerable extent on the amount of fermentable extract he can obtain from a given quantity; this in turn depends to a great degree on the nitrogen content of the original barley, barley being made up of starch, nitrogen in the form of protein, and fibre. The higher the protein content of the barley (i.e., the higher its nitrogen) the lower its value for malting and the higher its value for feed.

Barley for malting should be dry, sweet and free from evidence of heat or pre-germination. It should be rotund rather than long and lean, and free from split and skinned corns. It is important that the grains be even in appearance and ripeness because barley intended for malting must be capable of germinating at least 95 per cent quickly and vigorously. This quality cannot be judged by eye alone; it has to be determined by laboratory tests.

Harvesting and drying

An interesting pamphlet is produced by the Institute of Brewing, 33 Clarges Street, London, W.1. entitled *The Production and Storage of Malting Barley*. Among the points this pamphlet makes is the importance of correct harvesting. 'It is most disappointing', says the Institute, 'to see the number of samples ruined at harvest by incorrect setting of the combine harvester: research has shown that the drum requires frequent adjustments during the day in relation to the moisture content of the crop. The widest concave setting and slowest cylinder speed which will give a satisfactory standard of threshing should be employed on all occasions. Threshing damage to grain, e.g., skinning, makes it unsuitable for malting.'

Correct methods of drying and storing are vital to preserve sound germination and the following rules are suggested:

Harvesting. Unless harvested under exceptionally dry conditions, resulting in a grain moisture content of 15 per cent or under, freshly harvested barley cannot be stored in deep bulk or bin for more than four to five days. It will, however, store for some weeks in spaced sacks up to a maximum of 18 per cent moisture.

Drying. The higher the moisture content of the grain as harvested, the lower must be the 'inlet air' temperature. The temperature of the grain itself must never exceed 110°F (43°C).

Cooling. Barley must be cooled to a maximum of 65°F (18°C) immediately after drying to keep it sweet, free from mould and to avoid insect infestation.

Storage. Dried barley can be stored in silos or bins for long periods at a moisture not exceeding 15 per cent, provided there are suitable facilities and the contents of one bin are changed to another at frequent intervals, especially during the early weeks after drying. Bins or bulks of barley with no facilities for changing the grain from one to another can be stored for long periods only when dried down to not more than 15 per cent moisture: they must also be equipped with aeration facilities to reduce and maintain a temperature of 60°F (15°C) maximum.

Growing hops

The main areas for hop growing are Kent, Herefordshire, Worcestershire and Sussex; some are grown in Hampshire, Surrey and Berkshire. The total acreage under hops last year was 16,719, which was made up as follows: East Kent, 1,824 acres; Mid Kent 2,334; Weald of Kent 4,952, giving a total for the county as a whole of 9,110 acres. The acreage for the remainder was Herefordshire 4,021; Worcestershire 1,545; Sussex 1,433 and Hampshire, Surrey and Berkshire 610.

Production in 1969 totalled 216,000 centals (one cental = 100 lb), which with an average price of £33 12*s*. per cental made the crop worth well over £7m. This year the brewers have asked British hop growers for a figure in excess of 240,000 centals. This increase reflects the increased demand for beer—last year's output was some 4 per cent up on that of the previous year—and is also an indication of a tendency on the part of the drinking public to go increasingly for more highly hopped and, therefore, more bitter beers in preference to the milder, somewhat sweeter varieties.

Brewing

Having considered the growing of the barley and hops, and the converting of the barley into malt, it is pertinent to consider briefly how, from then on, they are used to produce beer.

When brewing is to commence, the malt is carefully crushed by being passed through rollers in the malt mill so that the maximum amount of valuable contents may be extracted in the next process. This is the mixing of the 'grist', as the crushed malt has become, with hot water, to form a sort of 'porridge' or 'mash' as it is known. In this mixing, the quality of the water and its temperatures are essential to correct brewing, as again the type of beer is affected by different temperatures. Any mistake at this point might spoil the whole brew. As the malt and water are mixed, they fall into a 'mash-tun' and are allowed to stand for a few hours at a certain temperature

before the wort is run off through the perforations in the bottom of the tun into coppers. The grist or grains, known as 'brewers' grains', left in the mash-tun are removed for use as a cattle food.

In the coppers, hops are added gradually. Sugar, also, may be added, depending on the class of beer being brewed. The whole is boiled for one to three hours. This serves to sterilize the wort as well as to extract the well-known bitter flavouring and preservative properties of hops. When boiling is complete, the wort is run off into a 'hop-back' which acts as a strainer to separate the spent hops from the clean hopped wort, and this passes into refrigerators or a cooling plant. Again meticulous care must be taken to see that any air coming into contact with the wort is filtered and pure, and for this purpose elaborate precautions are taken in modern breweries.

From the refrigerators the wort passes to the fermenting vessels which, when filled, are gauged by the brewer and excise officer to determine the specific gravity and volume of the beer on which duty is payable by the brewer. Yeast is added in the fermentation vessels and during this process carbon dioxide is released whilst alcohol is produced and retained; the yeast also reproduces itself about five-fold.

After about five days, when fermentation is complete, the yeast has risen into a frothy mass on top of the liquid and is skimmed off for use on future occasions. The remaining liquid—beer—is ready for casking or bottling. A few of the finest hops may also be put into the casks to impart further flavour, and the beer is then left to mature until ready for delivery to the public house and customer. Beer intended for bottling is passed direct into storage tanks and, when bottling is to commence, is filtered and passed into the bottling machines.

At all stages of modern brewing, scrupulous care has to be taken to see that cleanliness is maintained, and that constant expert attention is given to ensure that the beer produced is in the best possible condition and that the public receive a pure and safe drink.

No better brew

This is a much simplified account of a highly complex process that has been evolved over the centuries. However, despite the changes that have come about in recent years with the introduction of automated processes and new techniques in conditioning and distribution, the basic principles of 'the mystery' remain unchanged: extracting the goodness and strength from the barley and the flavour from the hops to make beer the best long drink in the world.

As Julius Caesar put it: 'The Britons have vines but use them only for arbours in their gardens. They drink a high and mighty liquor, different from that of any other nation, made from barley and water. This drink is not so subtle in its effect as wine, but it is as warming, even more nourishing, and leaves space enough for the performance of many great actions before the spirits are quite vanquished'.

This article has been contributed by **P. H. T. Evans** who is the Editor of Brewing Publications Ltd., publishers of *The Brewing Trade Review* and *The Brewers' Almanack*.

During the last decade the great land reform programme in Iran has re-fashioned the rural order of the country. **Prof. D. R. Denman,** Head of the University of Cambridge, Department of Land Economy, discusses

Land Reform in Iran (Part 1)

To IRAN, rich in history, tradition and classical literature, change does not come readily. All the more impressive, therefore, is the great land reform which over the last ten years has refashioned the rural order of the country. It is part of what the monarch of the Persian people, His Imperial Majesty Shahanshah Aryamehr, has called the White Revolution of Iran; a programme of social and economic advance which has increased the contribution of industry and commercial services to the Gross National Product from 40 to 67 per cent and reduced that of agriculture from 60 to 33 per cent.

Land reforms take standard forms. One gives legal recognition to a *de facto* arrangement developed over generations; another will redistribute land without altering the distribution pattern of land wealth; a third assigns property rights in the land from old hands to new and changes the tenurial system. The Iranian land reform belongs to the last of these three standard forms.

Royal concern

It began over twenty years ago in the care and concern which H.I.M. the Shahanshah had for his people. 'When I was still a student in Switzerland,' he wrote, 'I became seriously concerned about the plight of Persia's peasants . . . Day by day, this concern and my desire for the betterment of their state became stronger and stronger. Consequently, on my father's departure from Iran, I turned all my agricultural lands over to the government.' A royal decree was issued in 1951 under which more than two thousand villages and individual farms (*amlak*) in the ownership of the Shahanshah were assigned to the cultivators of the soil and the land distributed among them.

This generous and spontaneous action set the pattern but not the pace of the universal land reform. In Iran at that time much land was held as public domain (*Khaleseh*) under the hand of the Government. Following the Shah's lead and eventual request, legislation for the distribution of the *Khaleseh* was approved and enacted in 1955. For constitutional reasons, however, the actual programme of survey and transfer of titles did not begin until 1958.

In the meantime, the lead which the Shahanshah and Government had given was not followed by the owners of private land or by those who held land for religious and other purposes on arrangements which resemble but do not correspond to the trust known to English land law; these, the *vaghf* lands of Iran, are a source of particular complexity in the land reforms of the country.

The private lands, nevertheless, lay at the centre of the land reform problem, socially, economically and politically. Until these were caught up

in the land reform movement, the movement would appear no more than a personal affair of the Shahanshah and the administrators of the *Khaleseh* land. It was apparent that if Iran was to have land reform on a truly national scale, the legislature (*Majlis*) and Government would have to promote a policy of compulsion.

An early failure

The policy of the Shahanshah was greatly desired at home. Pressures, domestic and international, were upon the *Majlis* and in March 1960 the legislative assembly took the first steps towards a policy of compulsory land reform. In general landowners were required to transfer the titles of their land to the cultivators of it but there were many loopholes and impracticalities, probably by design, in the law and very wide categories of land were exempt.

To start with, a landowner could retain in his own hands 400 hectares (988 acres) of irrigated land, or 800 hectares (1,976 acres) of unirrigated land, or unlimited uncultivated land provided it was shown to be his intention to cultivate it. Land which had been cultivated for at least one season in the preceding two years was also exempt; so were woodlands, plantations, gardens and buildings used with land and, worthy of note, so was *vaghf*. To this liberality of exemption was tacked the right of a landowner within two years of the reform law to grant *inter vivos* to his legal descendants land up to the prescribed maximum. Strictly speaking such transactions were limited to a man's legal descendants, but in practice ways were found to arrange similar transactions in favour of others.

Underlying all this was the radical defect that in Iran at that time it was usually impossible to identify a landowner's proprietary domain in terms of hectares without the aid of surveys and maps specially made for the purpose. This first step in the direction of compulsory land reform was an acknowledged failure and engendered much dissatisfaction, especially in the vocal urban areas of the country.

Village policy: First Phase 1962

In the early 1960s, executive authority to implement the land reform policy was in the zealous hands of the then Minister of Agriculture, Dr. Arsanjani. But it was the personality of the Shah which stood out more clearly as the driving force at this critical turning point in the fortunes of land reform. The *Majlis* had been dissolved and policy was in the hands of the Monarch and Cabinet alone; by the time a new legislative assembly had reconvened, new legislation had been prepared for its approval. Little time was lost, for the new *Majlis* was of a different temper from the old; what was to become the foundation for the effective land reforms of Iran passed into law in January of 1962.

To understand the direction taken by the new law, one should realize that as a general rule the agrarian unit in the prevailing rural economy of Iran is the village. Here the fertile and the infertile, the dry and the irrigated land, water supplies from open and underground channels (*qanat*), grazing grounds, access ways and homesteads are distributed among the village inhabitants to be worked and fed with water according to ancient customs of tillage, management and law. Compared with 400 hectares of unsurveyed and unmeasured land, the village had a clear-cut identity; although when it

came down to defining a village in legal terms for the purpose of the law unsuspected complexities were discovered. Within a village, the land cultivated by the share-croppers of the landowner who owned the village was distributed among them in strip lands, somewhat similar to the old open fields of medieval England; the important difference was that irrigation rather than the share-out of good and bad land was the dominant factor behind the field layout (*nasaq*).

The magnitude of the land reformer's task is shown by the fact that throughout Iran 58,000 villages and 19,000 individual tenanted farms waited for redemption and reform.

The touchstone of the new land reform policy of 1962 was the village. A landowner was permitted to retain one entire (*shesh-dang*) village; this meant a village whose wholeness was comprised of six parts. A man who owned more than one village or proportions (*dang*) of a number of villages could hold his permitted lands in more than one of the villages, but only to the extent that the scattered portions did not in the aggregate exceed the equivalent of a *shesh-dang* village. Naturally landowners chose the largest and best of their villages for retention and it was a nice point to decide sometimes whether or not a settlement was a village or a town within the meaning of the land reform law.

Land in excess of the maximum permitted to a landowner was compulsorily acquired by the Ministry of Agriculture who subsequently passed the title to those cultivators and share-croppers entitled to it under the law. Within the Ministry a special department known as the Land Reform Organisation was set up. It was from this nucleus that a new Ministry of Land Reform and Rural Co-operation grew up in 1967, now fully operative under its first and most efficient Minister, His Excellency Dr. A. A. Valian. The retention of a *shesh-dang* village and the Government acquisition of all excess land for transfer to the share-croppers was the essential pattern of the First Phase of the land reform; by June 1969, 15,710 villages some 801 individual farms had changed hands.

Landowners were compensated by a purchase price calculated according to a specific formula, paid as an initial cash payment with the remainder in instalments over fifteen years. At an early stage, land bonds carrying interest were issued by the Government as a means of satisfying payments to the landowners. Special provision was also made for landowners to be compensated by shares in Government sponsored factories. The purchase price was based upon the past tax returns made by the landowners and a years' purchase multiplier, known as a land transaction co-efficient and calculated for specific regions. It took into account the date of the last tax return, type of farming, share-cropping arrangements, location of the villages and other factors. It was a rough and ready way of determining prices for the land taken, but it penalised those who had made fraudulent tax returns.

Titles were given to share-croppers in a manner characteristic of Iranian practice and thought. Each peasant receiving land would have assigned to him not a clearly identified plot but a property right held jointly by him and unnamed fellow villagers. The extent of his land would be in proportion to the lands of the village he had, by custom, been cultivating. Payment for the land by the peasant reflected the price paid for it by the Government and was spread over fifteen years. Outstanding balances carried 10 per cent interest which was used for development projects for Iranian agriculture.

(Part 2—Second and Third Phase will appear in the September issue of 'Agriculture'.)

37. Radnorshire

A. W. Prowel

RADNORSHIRE is possibly the least well known of the Welsh counties and certainly the most sparsely populated. It is completely rural and unspoilt.

To the west is the central mass of the Cambrian Range and to the east the English border countryside. It is not surprising, therefore, that the people tend to have an identity of their own. The total population is around 19,000 —the equivalent of a fair sized town. The inhabitants, dispersed as they are over the whole county, can be said to dwell in the country. A glance at the map will show how very similar is the county in shape to the continent of Africa. Over 85 per cent of the land is over 1,000 feet. The charm of its hills and uplands is their variety of shape and colour, the large open stretches of moorland, steep tree-clad slopes and green valleys.

Nowhere are you far from a stream or river. The Wye enters the county in the north-west between Rhayader and Llangurig, and from Rhayader south forms the county boundary until it meets Herefordshire at Hay-on-Wye in the south-east. To fishermen everywhere the Wye is famed as a salmon river. In its upper reaches and tributaries it is also the happy hunting ground for trout fishermen.

The Land and its use

In the extreme north-west the land rises to around 2,000 feet above sea level, the underlying parent rocks are poor in base materials, and the area is mainly tree-less moorland almost entirely devoted to hill sheep grazings. These are the Elan and Claerwen water gathering grounds for the Birmingham Corporation. The primary use of this hill land is supplying water to the large midland industrial area. Agriculture, and forestry too, are subsidiary to the over-riding consideration imposed by the demand for water. The Corporation, within the constraints imposed for these requirements, encourages agricultural use of the land. As controlling authority the Corporation provides services and also fixed equipment. Its activities generally help to foster and maintain a community life in the area. Occupiers of hill farms benefit from renting their hill sheep flock. Nevertheless, there is extreme rigidity in the system. The land is still subject to common rights which prohibit both the Corporation and the tenants from fencing it. This not only makes for difficulties in management of hill sheep but inhibits breeding development and also restricts improvement work to land.

To the east and south a different soil type and lower rainfall gives rise to a marked change in the farming; moorland gives way to dry uplands and

Speckleface and Kerry types of sheep are seen—much bigger sheep. Here there is a good balance between cattle and sheep and a patchwork pattern of grassland and tillage.

The system of sheep production from here right through to the east of the county towards Knighton, has been based largely on the production of breeding ewes and Hereford type store cattle for sale to the low ground farming areas in England.

Until quite recently, the sale of the younger type of breeding ewe from these upland areas of Radnor has been an enterprise of considerable importance. A complete range of type is found starting in the north-western uplands with a ewe which can be one cross removed from Welsh to pure Kerry or Clun in the east. Different areas are traditionally identifiable for the sale of a particular type of ewe and this is well known by buyers. The sales specialize in young ewes and this, over the years, has imposed very real technical limitations and problems on producers. Young yearling ewes and a proportion of ewe lambs put to the ram means particular attention being required at lambing time. Again the system implies that ewes leave the farms at a point in time before they have reached their most productive stage. What this system has brought about is a high level of selectivity in breeding and also a very good standard of winter feeding. The county abounds with good sheep men. To the east and south-east arable crops play an important part in the farming economy.

In the Radnor valley and the valley of the Lugg, the lower rainfall plus favourable soil and terrain make these areas highly suitable for cereal production. In the lower Wye valley also, deep red sandstone soils are capable of growing excellent crops of barley, wheat and oats. At Hay-on-Wye the Hay/Talgarth Seed Growers Federation have for many years specialized in marketing high quality cereal seed grown in the surrounding districts of Brecon, Radnor and Hereford.

The main market towns are Rhayader, Knighton, Hay-on-Wye and Builth Wells. All these market centres are dotted around the edges of the county and are well known for their autumn ewe and store cattle sales. During the last fifteen years, with the exception of Rhayader, they have become equally well known for their producer sponsored weaned calf sales. The Brecon and Radnor Suckler Calf Association markets between 8,000 and 9,000 calves annually in the counties of Brecon and Radnor. These go to all parts of the country either for yarding and fattening during the winter or on to farms where they are finished at grass the following year. Builth Wells is the South Wales centre for the Welsh Half-Bred sheep sales. During recent years the sale has been held on the Royal Welsh Show Grounds at Llanelwedd. The Royal Welsh Agricultural Society has been based at the permanent site at Llanelwedd Hall since 1963.

Trends and developments

One of the features of farming in the county is the vast area of hills and uplands which have been reclaimed, mainly from bracken. The main impetus to this work was given by the Government subsidy of £2 per acre for land reclamation in 1939. One of the many pioneers at this time was Mr. R. Watkins of Dolau House near Penybont in mid-Radnorshire, who ploughed, pioneer cropped, reclaimed and fenced large tracts of land at 1,500 feet

above sea level on the slopes of the Radnor Forest. Many others have followed since. Sheep, particularly, increased rapidly right up to 1968. Cattle numbers have also increased but the steep rise in breeding cows came a little later.

Cattle have presented problems of winter housing and winter fodder. Considerable strides have been made in this sector during recent years. Traditional systems in many cases have had to change; loose housing of cattle and self and easy feed systems have had to be adopted. Herd size and sheep numbers have increased against a background of a decreasing labour force on farms. Capital injection in buildings, equipment and machinery have taken the place of labour as far as this is possible under livestock farming.

Other changes which have taken place are concerned with the type of suckler cow kept. An increasing number of cross bred cattle are now being reared where traditionally the Hereford reigned supreme. Market demand has also brought about changes in sheep production. With the decline in the sheep population in the English countryside the market for the sale of breeding ewes is much smaller and, since 1967, there has been a pronounced swing from breeding of sale ewes to fat lamb production. Livestock density is high in the county and wintering of livestock still remains a crucial factor in production.

Producer co-operation in marketing has been an activity which many progressive men have seen as their goal, and it has been through the efforts of such people that the Suckler Calf Association, the Pig Weaner Group and the Seed Potato organizations have been established.

In an entirely rural community there is little scope for employment outside farming and its ancillary trades. Population is tending to decline, and considerable amalgamation of holdings has taken place over the years. Forestry has developed alongside farming since the late 1930s and many of the remoter upland areas to the north-west have been planted to trees.

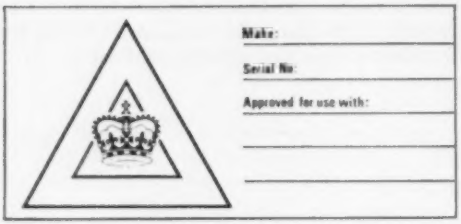
The present day farmer and the young men taking over from their fathers have a tremendous capacity for farming, and in the main are well endowed with business acumen. They also have tremendous feeling for the land as an inheritance. All of which promises well for the future.

Thoughts on Farm Traffic

R. C. Leeson, *Agricultural Land Service, Bristol*

REGULATIONS plus implements can equal problems on the farm. R.I.P. most will say, but problems are costly, and cannot be put aside and forgotten. A few random thoughts how they might be overcome may, therefore, be helpful.

In accordance with regulations made by the Minister of Agriculture, Fisheries and Food and the Secretary of State for Scotland the fitting of safety cabs to new tractors becomes compulsory with effect from 1st September, 1970. For tractors already in use the operative date is 1st September, 1977. Cabs must be of an approved design which complies with British Standard 4063:1966 and must display an approval mark on the following lines:



Not to Scale

In cases where it is not reasonably practicable to have approved cabs fitted there are exemptions to these requirements, for example in hop gardens, hop yards, orchards and in or close to buildings. Full details are given in the *Farm Safety Guide to the Safety Health and Welfare Act and Regulations* (*January 1969*), obtainable from local Divisional Offices of the Ministry (free of charge).

Problems

What are the problems that are likely to arise? First, doorways of buildings to be entered by tractors fitted with safety cabs will need to be of a minimum height of 9 ft. Possibly little or no thought will have been given to the fact when converting existing buildings that cabs may be up to 8 ft 9 in. above floor level and 3 ft wide: for example, by the dairy farmer when constructing cattle housing, such as cow kennels, with low ridge heights; or in converting existing buildings for cubicles and loafing areas. If he wishes to use his tractor for scraping he is now faced with the problem of avoiding roof timbers obstructing the tractor cab. Fixing and unfixing the cab on each occasion scraping has to be carried out can be time consuming.

What is the answer? New kennels can, of course, be designed with sufficient roof clearance to permit the use of tractors fitted with cabs; but the farmer with existing kennels of insufficient height who does not wish to convert to manual scraping will, no doubt, think of investing in a small low horse-powered tractor for use within buildings. By this means he will have the larger tractor fitted with cab available to work to full capacity outside, and the small tractor for use in his low buildings and for other odd jobs around the homestead.

Next, consider the existing tractor shed. Will this meet the new height restrictions? Roof struts and electricity power lines that previously were unnoticed could now be a source of danger. Access around the homestead could become another problem as produce and materials are increasingly handled in bulk.

Modern bulk milk and grain tankers can measure up to 33 ft long and 8 ft wide with a turning circle of 68 ft. Access to the farm directly off a public highway will need to be 50–60 ft wide so that a tanker can enter the premises without causing a hazard to other road users. Access doors for bulk grain lorries need to be of a minimum height of 14 ft. Easy access to the dairy or grain store so that the tanker can be positioned immediately at its pick-up point, and so overcome the necessity for three-point turns, is another important consideration to bear in mind.

Old concrete roads and brick culverts over watercourses need to be inspected to ascertain their ability to withstand a 20-ton rolling load. When constructing new concrete roads the cost of incorporating a steel mesh reinforcement is a worthwhile investment, especially on poor load bearing soils. If an unreinforced concrete road cracks and is then subjected to frost and heavy loads it may, within a few months, be necessary to relay a completely new road.

Finally, remember that regulations such as those relating to safety cabs are made for the benefit of the farmer and his workers and so must be complied with. This is made easier if the right implement for the job is used and if buildings and lay-out requirements are carefully considered at the outset, thereby possibly saving both time and money. Therefore plan wisely, thinking of next year not next month. All these will add up to less problems which, if small enough, can then be left to rest in peace.

in brief

- **Farm size structure in Scotland**
- **Pasture and palatability**
- **Milk on tap**

Farm size structure in Scotland

FUNDAMENTALLY the viability of any country's agriculture depends upon its molecular strength. Scotland's agriculture has come up the hard way to its present importance, and since the war has been turning yet another page in its history as adaptations and changes have been made to meet new economic pressures. The rate of change has probably never been greater than that experienced in the past ten to fifteen years, which is now seen to be reflected in the farming size structure as described by Mr. T. P. Russell in the current issue of *Scottish Agricultural Economics**. The emergent pattern of bigger farms at the expense of smaller businesses continues to develop. In 1945 there were nearly 76,000 agricultural holdings in Scotland (the same as in 1920); in June 1969 the total was a little over 55,000, with the fall most marked in the North-East (30 per cent) and the East Central regions. Between 1965 and 1969 the average rate of decrease over the whole country has been 0·8 per cent. Many holdings in Scotland are, of course, very small, doubtfully meriting the description of 'farms'; in fact, as Mr. Russell shows, no less than 33,000 holdings, including most of the 15,000 crofts, were classified as part-time in 1969. Also, despite paper amalgamations, there is a considerable number of 'multiple units', where two or more holdings are in common ownership although continuing to keep their identities as distinct operating units.

The physical features of Scotland, contrasting acutely from the rich, improved soils of the Lowlands to the desperate soils of the Highlands, inevitably influence farm size as much today as they have done throughout Scotland's history—the one encouraging the large enterprise, the other leading to a multitude of small crofts (nearly three-quarters of all holdings) alongside the large estate. Two other factors also exert considerable influence on farm size structure—the conditions of land tenure and the availability of labour. Increasingly since the beginning of this century occupier-ownership of farms has taken over from the *rentiers*, though the general tendency is for owner-occupation to be associated more strongly with the bigger farms. By 1968 over 59 per cent of the total area of agricultural land in Scotland was owner-occupied and fairly evenly distributed geographically.

The attraction of industry continues to denude land of labour, and since 1961 the rate of decline in the full-time paid agricultural labour force in Scotland has averaged almost 7 per cent per year. But, says Mr. Russell, 'it should be remembered that a 6 per cent reduction in full-time labour does not necessarily mean a 6 per cent reduction in the labour input on the farm. In fact, it probably means a

*Vol. XX–1970, obtainable from H.M.S.O. (address on p. 396) price 9s.

reduction of less than half this amount, since there are estimated to be some 50,000 working occupiers, not to mention their wives, making a very substantial contribution to labour input. Furthermore, the input of contractors' services is steadily increasing'. The figures of the distribution of full-time labour between farms show that 70 per cent of the holdings have no full-time labour, and another 20 per cent employ only one or two workers. Of the farms with regular workers, 39 per cent employ only family labour.

Pasture and palatability

THE philosophy that father knows best, as applied to the relationship between the farmer and his grazing animals, not infrequently takes some hard knocks. Rejection of a pasture is not necessarily to be construed as just sheer perversity, but calls for closer examination. We all know what we like, and it is reasonable to accord to cattle and sheep their own preferences. Catering for pasture palatability is the immediate inducement to serious grazing, which in turn puts on the flesh or goes into the milk bag. There is no profit in aimless meandering.

It may be the actual composition of the sward that holds little attraction, especially when stock are put into a fresh field to find, for example, the less palatable timothy/fescue instead of a perennial ryegrass/timothy/white clover mixture; or where the more vigorous ryegrass has unbalanced the pasture as the result of a poor establishment—as could well be the case this year with its cold spring. Understocked leys are themselves an invitation to the production of unpalatable herbage, setting up a rake's progress the result of which will be all too obvious in declining stock performance. Likewise overgrazing in the early part of the year and undergrazing subsequently in the season, as often happens with 'set' stocking, leads inevitably to heavy weed infestation.

Thus good management is mandatory if the quality of pasture land is to be maintained at a remunerative level throughout the growing season. Seed mixtures of high feeding value, good (even inspired) manurial treatments and optimum stocking rates are three pointers to titillating the appetites of grazing animals and obviating the silent protests which show up in the farm balance sheet.

Milk on tap

IN the long, hard look along the road ahead for the milk industry given by the delegates to the Annual Conference of the National Dairymen's Association it was predictable that the question of the seven-day-a-week household deliveries of milk would be voiced. On the one hand, labour difficulties and greater costs militate against its continuation, but on the other any reduction in the doorstep service would inevitably have the effect of reducing consumption. This particular nettle has been growing apace for some time, and it was therefore of interest to see Mr. J. H. Penny, Head of the M.M.B's Sales Division, grasping it firmly by his suggestion of putting milk in the home on tap.

This could be done, he suggested, by the delivery of one gallon disposable bags in box bulk containers which would fit into a two gallon capacity refrigerated unit fixed to the kitchen wall and fitted with a pinch valve tap. He thought that the cost of the unit might be around £15–20 and could be made available on hire purchase or on simple hire. Mr. Penny claimed that the increased cost of bag-in-box packaging over that of milk bottling is marginal and offset by savings in bottle washing and the easier handling of bulk.

Here is certainly an idea which could sell more milk and lighten the load of the milkman, but it would be of interest to have the reaction of housewives.

AGRIC

Books

Scientific Horticulture. Volume 21. HORTICULTURAL EDUCATION ASSOCIATION. Elvy and Gibbs, 16 Orange Street, Canterbury, Kent, 1969. 35*s*. [£1·75] (by post 36*s*.) [£1·80].

Over ninety pages are devoted to modern management techniques in this issue. Several aspects of physical and financial management planning are covered. A. W. Hales illustrates a technique for selecting enterprises in a horticultural business in his article on Linear Programming, while A. E. Maddison develops the planning theme with a contribution on Critical Path Analysis, in which he describes a tool used by management to ensure that a logical and efficient plan is produced, enabling changes to be implemented successfully in the shortest possible time. For illustration, he includes a network of the erection of a commercial glasshouse. J. F. Crozier examines the worthwhileness of capital investment in projects with a clear exposition of Discounted Cash Flow. Having planned the business, D. J. Thrift explains the principles of an accounting system to give information management requires to effectively control production on profitable lines. P. C. Rose explains how the Computer already serves managers through the mechanization of clerical work, and how in the near future it should assist in staff management and decision making.

Personnel Management is the subject of an interesting paper prepared by Dr. F. Mayo, while an outline of Work Measurement is given by G. Slater. J. Matthews, in his article on Ergonomics, describes concisely the factors which affect efficient performance of man and machine. A feature of the journal is the inclusion of a selected list of books on management services.

W.J.S.

The Herdsman's Book. KENNETH RUSSELL. (Revised by STEPHEN WILLIAMS). Farming Press, 1969. 35*s*.

In October, 1956, Kenneth Russell prefaced his first edition with the words 'This book has been written in the hope of providing a code of good husbandry for the guidance of those whose job it is to tend our dairy and beef cattle'. The new edition closes with the phrase 'No matter how well planned a farming system may be, its success ultimately depends on how successful is the execution of that plan, and in cattle farming good stockmanship reaps a rich dividend'. These quotations illustrate what the author intended to achieve, and the measure of his success is that this book has remained one of the best sellers written in agricultural literature for fourteen years.

Kenneth Russell's unique skill as a husbandman is seen on every page and his sincerity and sense of mission have resulted in a simple, lucid style of writing which one would like to see more frequently in the works of technical authors.

The interest shown by Stephen Williams in livestock husbandry and animal welfare and behaviour is universally recognized, so no one is better fitted to take on the solemn task of completing the revision which the passage of time has demanded and which Mr. Russell had already started before he died. Mr. Williams' influence is particularly apparent in the chapter on handling the herd, where his observations on animal behaviour are transposed into useful practical aids.

The book remains a classic guide for all those whose daily work is concerned with the care of cattle, and modern systems involving more intensive cattle enterprises makes it increasingly valuable.

There is little to criticize in content or presentation although, to help in standardizing technical phraseology, 'livestock unit' would have been preferable to 'cow equivalent' as they amount to the same thing. Not everyone would agree with the recommendations on grazing lucerne or the suggested service age for dairy heifers; this, together with the views expressed on steaming-up and the calving period for suckler herds, would have benefited from revision in the light of present thinking. But, all in all, if the precepts of this book become the practice of our stockmen our cattle industry has little to fear.

G.H.B.

Tourism and the Cornish Farmer. (Report No. 175). E. T. DAVIES. University of Exeter, 1969.

Once upon a time the greater part of the farming community in the west of England, and Cornwall in particular, lived out its life in a not so splendid isolation. The motor-car has altered all that, bringing directly or indirectly to an increasing proportion of its people a new facet of economic life catering for the holiday-maker and tourist. If we now add to this the pressure of current economic problems on a county in which small farms predominate, the survey which the Department of Agricultural Economics of the University of Exeter carried out in the spring of 1968 into the potential of farmer interest in this field, augmenting an initial inquiry the previous year, is a useful index to current thinking among small farming households and the financial contribution that holiday catering could make.

Of the 10,700 Cornish farmers, it appears that only a little over 18 per cent provide holiday accommodation, mainly bed and breakfast plus an evening meal and for the most part on farms of under 50 acres, but another 20 per cent would do so if they had suitable facilities and the staff. Together these amount to just over 4,100, some two-fifths of the entire farmer population. This figure, however, could be increased if existing amenity areas attracted more tourists and the holiday interest was more widely based on an essentially commercial approach, especially since nearly nine out of every ten farmers questioned in the survey supported the view that 'tourism was a realistic means by which low farm incomes could be alleviated'.

It is visualized that in the light of an estimated annual increase of visitors to Cornwall of the order of 4½ to nearly 6 per cent by 1981, the popularity of such holiday areas as Lizard/Falmouth and Bodmin Moor could readily be extended, e.g., east of the Fal estuary. The survey shows that the opportunity exists, and a further study planned by the University of Exeter should reveal the factors that are at present limiting the appeal of tourism in Cornwall, both geographically and numerically.

This survey, price 2*s.* 6*d.*, is available from the University, St. German's Road, Pennsylvania, Exeter.

S.R.O'H.

Food Industries Manual. (20th Edition). Edited by A. H. WOOLLEN. Leonard Hill, 1969. Ten guineas. [£10·50].

This encyclopaedia of food technology contains fifteen chapters arranged in alphabetical order from 'Baking' to 'Storage, Refrigeration and Handling'. It contains chapters on commodities—confectionery; the dairy industry; fats and fatty foods; fish processing; fruit juices and fruit juice beverages; meat and meat products; flour and flour milling; preserves; and pickles and sauces—and on treatments—canning and freezing; dehydration; and packaging as well as the two already mentioned. A new chapter on nutrition is an innovation since the nineteenth edition which was published seven years ago. Several of the other chapters contain statements on the nutritive value of the product under discussion, for example, cheese and milk, and the chapter on canning and freezing contains a useful summary on the nutritional value of canned and frozen foods.

Each chapter consists of a series of short sections under headings arranged in alphabetical order. These include commodities, processes, technical terms, chemicals used in processing, equipment, quality and composition of foods, recipes and much more. Examples from two chapters will give an indication of the arrangements. The first five headings in the chapter 'Fish Processing' are anchovies, angle of repose, antibiotics, antioxidants, and ash, while the first five in 'Pickles and Sauces' are acetic acid preservation, acid constituents, pickled beetroot, colouring matters and enzymes.

This is essentially a reference book, intended for the executives, managers and chemists in large and small businesses. It would, however, also be useful for students of food technology and others who need a handy compilation of up-to-date information on this complex range of subjects. Many of the chapters give good lists of references and suggestions for further reading.

My only criticism is that, with one notable exception, no statement is made as to the places of work or the range of experience of the contributors. It would have been helpful to the reader if a few bibliographical details had been given about each.

D.F.H.

books received

Pig Production in Kent 1967–1969. Copies from Department of Agricultural Economics, Wye College, Ashford, Kent. 1970. 5*s*.

A Study of Labour Turnover. Economic Development Committee for Food Manufacturing. Enquiries to National Economic Development Office, Millbank Tower, 21/41, Millbank, London, S.W.1.

Farm Management Notes. 1969. No. 40. University of Nottingham. 5*s*.

Agricultural Research Council Letcombe Laboratory Annual Report 1969. H.M.S.O., 1970. 12*s*.

Institute of Animal Physiology Babraham Cambridge Report for 1968–69. H.M.S.O., 1970. 15*s*.

National Institute for Research in Dairying Biennial Reviews 1970. Copies from the Librarian, N.I.R.D., Shinfield, Reading, Berkshire, RG2 9AT. 8*s*.

Rothamsted Experimental Station Report for 1969 Parts 1 and 2. Copies from the Librarian, R.E.S., Harpendon, Herts. Price (post free) for both parts 30*s*. (not sold separately). 1970.

The Intensification of Beef and Sheep Production. Copies from Reading University Agricultural Club, University of Reading, RG6 2AT. 1970. 5*s*. 6*d*.

Farm Organisation and Incomes in South West England 1968/69. S. T. Morris, H. W. B. Luxton G. D. D. Davies and B. R. Nixon. University of Exeter, 1970. 7*s*. 6*d*.

Economic Aspects of Milk Production in South West England 1968/69. Betty J. Roscoe and H. W. B. Luxton. University of Exeter, 1970. 5*s*.

Agricultural Chemicals Approval Scheme

Sixth List of Additions to the 1970 List of Approved Products for Farmers and Growers.

NEW CHEMICAL

CARBOXIN with MERCURY

A mixture of a systemic organic fungicide with organomercury compounds for control of loose smut and other seed-borne diseases of barley and wheat.

Dry Seed Dressings

Murganic RPB—Murphy

ACKNOWLEDGMENT OF PHOTOGRAPHS

We gratefully acknowledge permission to use the following photographs:
Front Cover The Harewood Estate. P. 350 B. Elsoms Ltd. P. 354 C. H. D. Acland. P. 357 The National Trust. P. 362 Lincolnshire Free Press. P. 379 G. T. Bills. P. 380 P. H. T. Evans.

AGRICULTURE

Price 1s. 6d. [7½p] net monthly (by post 2s. [10p])

Postal subscription rate, Home and Overseas: £1 4s. 0d. [£1·20] per annum

Subscriptions may start with any issue and should be sent to:

HER MAJESTY'S STATIONERY OFFICE

49 High Holborn, London W.C.1
13a Castle Street, Edinburgh EH2 3AR
Brazennose Street, Manchester M60 8AS
258 Broad Street, Birmingham 1
109 St. Mary Street, Cardiff CF1 1JW
50 Fairfax Street, Bristol BS1 3DE
7 Linenhall Street, Belfast BT2 8AY

Single copies can be purchased from any of the above-mentioned addresses or through a bookseller.

Printed in England for Her Majesty's Stationery Office by Hull Printers Limited, Willerby, Hull, HU10 6DH.

(K80) SBN 11 72144 6

The Changing Structure of Agriculture

The publication in 1966 of a report on 'The Structure of Agriculture' marked a new stage in the development of agricultural statistics in the United Kingdom and was made possible by automatic data processing of the agricultural censuses. The present report shows that significant changes are taking place and indicates what these changes are.

6s. 6d. (by post 6*s.* 10*d.*)

Agricultural Bulletins:

Swarming of Bees

In recent years there has been much research into bee behaviour and swarming in particular has received considerable attention. In this new publication, the Ministry of Agriculture, Fisheries and Food's Bee Group relates the work of research scientists to practical bee-keeping. (Bulletin 206)

4s. 6d. (by post 4*s.* 10*d.*)

Issued in new editions:

Beneficial Insects and Mites

Gives an account of certain insects and mites whose activities are of vital importance. These are pollinating insects, and those which live at the expense of other related creatures, also plant feeding insects which have proved beneficial as weed control agents. 8 pp. coloured plates. (Bulletin 20)

17s. (by post 17*s.* 8*d.*)

Strawberries

Provides information on all aspects of growing strawberries including choice of site, cultural operations and marketing, propagation (including mist propagation), cold storage of runners and the certification scheme. (Bulletin 95)

10s. 6d. (by post 11s. 2d.)

Free lists of titles (please specify subject/s) are available from Her Majesty's Stationery Office, P6A, Atlantic House, Holborn Viaduct, London E.C.1.

HMSO

Government publications can be bought from the Government Bookshops in London (post orders to PO Box 569, SE1), Edinburgh, Cardiff, Belfast, Manchester, Birmingham and Bristol, or through any bookseller

books received

Pig Production in Kent 1967–1969. Copies from Department of Agricultural Economics, Wye College, Ashford, Kent. 1970. 5*s*.

A Study of Labour Turnover. Economic Development Committee for Food Manufacturing. Enquiries to National Economic Development Office, Millbank Tower, 21/41, Millbank, London, S.W.1.

Farm Management Notes. 1969. No. 40. University of Nottingham. 5*s*.

Agricultural Research Council Letcombe Laboratory Annual Report 1969. H.M.S.O., 1970. 12*s*.

Institute of Animal Physiology Babraham Cambridge Report for 1968–69. H.M.S.O., 1970. 15*s*.

National Institute for Research in Dairying Biennial Reviews 1970. Copies from the Librarian, N.I.R.D., Shinfield, Reading, Berkshire, RG2 9AT. 8*s*.

Rothamsted Experimental Station Report for 1969 Parts 1 and 2. Copies from the Librarian, R.E.S., Harpendon, Herts. Price (post free) for both parts 30*s*. (not sold separately). 1970.

The Intensification of Beef and Sheep Production. Copies from Reading University Agricultural Club, University of Reading, RG6 2AT. 1970. 5*s*. 6*d*.

Farm Organisation and Incomes in South West England 1968/69. S. T. Morris, H. W. B. Luxton G. D. D. Davies and B. R. Nixon. University of Exeter, 1970. 7*s*. 6*d*.

Economic Aspects of Milk Production in South West England 1968/69. Betty J. Roscoe and H. W. B. Luxton. University of Exeter, 1970. 5*s*.

Agricultural Chemicals Approval Scheme

Sixth List of Additions to the 1970 List of Approved Products for Farmers and Growers.

NEW CHEMICAL

CARBOXIN with MERCURY

A mixture of a systemic organic fungicide with organomercury compounds for control of loose smut and other seed-borne diseases of barley and wheat.

Dry Seed Dressings

Murganic RPB—Murphy

ACKNOWLEDGMENT OF PHOTOGRAPHS

We gratefully acknowledge permission to use the following photographs: Front Cover The Harewood Estate. P. 350 B. Elsoms Ltd. P. 354 C. H. D. Acland. P. 357 The National Trust. P. 362 Lincolnshire Free Press. P. 379 G. T. Bills. P. 380 P. H. T. Evans.

AGRICULTURE

Price 1s. 6d. [7½p] net monthly (by post 2s. [10p])

Postal subscription rate, Home and Overseas: £1 4s. 0d. [£1·20] per annum

Subscriptions may start with any issue and should be sent to:

HER MAJESTY'S STATIONERY OFFICE

49 High Holborn, London W.C.1
13a Castle Street, Edinburgh EH2 3AR
Brazennose Street, Manchester M60 8AS
258 Broad Street, Birmingham 1
109 St. Mary Street, Cardiff CF1 1JW
50 Fairfax Street, Bristol BS1 3DE
7 Linenhall Street, Belfast BT2 8AY

Single copies can be purchased from any of the above-mentioned addresses or through a bookseller.

Printed in England for Her Majesty's Stationery Office
by Hull Printers Limited, Willerby, Hull, HU10 6DH.

(K80) SBN 11 72144 6

The Changing Structure of Agriculture

The publication in 1966 of a report on 'The Structure of Agriculture' marked a new stage in the development of agricultural statistics in the United Kingdom and was made possible by automatic data processing of the agricultural censuses. The present report shows that significant changes are taking place and indicates what these changes are.

6s. 6d. (by post 6*s.* 10*d.*)

Agricultural Bulletins:

Swarming of Bees

In recent years there has been much research into bee behaviour and swarming in particular has received considerable attention. In this new publication, the Ministry of Agriculture, Fisheries and Food's Bee Group relates the work of research scientists to practical bee-keeping. (Bulletin 206)

4s. 6d. (by post 4*s.* 10*d.*)

Issued in new editions:

Beneficial Insects and Mites

Gives an account of certain insects and mites whose activities are of vital importance. These are pollinating insects, and those which live at the expense of other related creatures, also plant feeding insects which have proved beneficial as weed control agents. 8 pp. coloured plates. (Bulletin 20)

17s. (by post 17*s.* 8*d.*)

Strawberries

Provides information on all aspects of growing strawberries including choice of site, cultural operations and marketing, propagation (including mist propagation), cold storage of runners and the certification scheme. (Bulletin 95)

10s. 6d. (by post 11s. 2d.)

Free lists of titles (please specify subject/s) are available from Her Majesty's Stationery Office, P6A, Atlantic House, Holborn Viaduct, London E.C.1.

HMSO

Government publications can be bought from the Government Bookshops in London (post orders to PO Box 569, SE1), Edinburgh, Cardiff, Belfast, Manchester, Birmingham and Bristol, or through any bookseller

MINISTRY OF
AGRICULTURE, FISHERIES AND FOOD

Plant Pathology

A quarterly publication presenting original contributions on plant diseases, plant pests, rodent and bird damage, nutritional and physiological disorders of interest to the mycologist, entomologist, helminthologist, soil or nutrition chemist, plant physiologist and meteorologist.

Single copies 8s. 6d. (by post 9s.)

Yearly subscription 36s. (including postage)

Published by

HER MAJESTY'S STATIONERY OFFICE

and obtainable from the Government Bookshops in London (post orders to P.O. Box 569, S.E.1), Edinburgh, Cardiff, Belfast, Manchester, Birmingham and Bristol, or through any bookseller